University of Glasgow.

Thesis for the Degree of M.D.

The Field of Vision, with Special reference to its Anomalies in Diseases of the Nervous System:

accompanied by an Atlas of Plates illustrative of Cases.

by

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I hereby declare that in the preparation and composition of this Thesis I have not received any assistance from any person.

William Wallace

Index and Synopsis.

Since Helmholtz made the discovery that it was possible to illuminate the fundus of the eye, and study the details and pathological changes of the optic nerve, retina and choroid, Ophthalmologists have been seeking for signs to explain changes, which, though apparent to the observer's eye, and to a certain degree comprehensible, leave much in the region of conjecture.

In the majority of diseases it is possible to confirm on post-mortem examination the diagnosis, but in the cases of affections of the fundus of the eye one is not always able or at liberty to verify conclusions arrived at during life by dissections or microscopic examinations after death.

In many cases of diseases of the nervous system where what have been vaguely termed

termed "Eye-symptoms" have been present, an examination of the optic nerves is altogether omitted.

The researches of Charcot and Grasset have established (as definitely as is possible in these days when the hypotheses of Medical Science resemble the chameleon in the manner in which they change) that the condition called Hemianopsia is due to pressure in a certain region in the brain, and in locomotor ataxy (in some cases at least) a definite appearance of the disc has been described as pathognomonic. But in the vast majority of diseases the subjective symptoms remain obscure.

In this class of signs comes the study of the Field of Vision or Perimetry.

Ptolemy

1) Arago - "Astronomie" vol i. p. 145 quoted in de Wecker + Landolt "Traité complet d' Ophtalmologie" vol i. p. 611.

Ptolemy[1] was aware that the area of the field of vision was limited in certain directions, but it has been left to Aubert, Förster and von Graefe in our own day to establish our present knowledge of the subject on definite lines, till some one contradicts them.

Certain facts as to the shape of the visual field when projected on to a flat surface, and the relations of the areas for different colours have been accepted, and these with the theories as to the causation of visual and colour perception constitute our knowledge of the physiology of the subject.

On the pathological side it is known that in some cases there is a loss of vision in certain directions, either peripheral or central, in others that the fields appears unduly

Small

1) Abadie. "Leçons de Cliniques Ophtalmologie" p 758 seq.

small, the areas for colours being concentrically contracted or overlapping one another.

It is also stated by Abadie [1] that in certain cerebral states the fields for colours have a definite disposition to one another, but how he arrives at this conclusion he does not inform us.

Every phenomenon in nature must have some explanation, and in time the explanation will come, but in this matter of the Field of Vision it can be definitely asserted that, while we know that the phenomena are present, their raison d'être is in most cases a sealed book. Pathological investigation is difficult, in many cases impossible; time is not easily to be spared, and the multiplication of time-saving apparatus to perform mechanically

1) In Paris the taking of the field is done very hurriedly, a few minutes sufficing to make the measurment. Of the following fields I found that with an intelligent patient the measurments of both eyes for all the colours could be done in not less than half an hour, but intelligent patients were rare. Many, especially those in which scotomata were present took about two hours, while in other cases in which the patients answers were doubtful or hesitating the measurment had to be made twice at one sitting. In most of the cases a selfregistering instrument was useless.

mechanically an examination which must not be hurried over is in itself a barrier to just conclusions. Even the mechanical structure of the Perimeter may be the cause of results varying, and in no small degree the lack of intelligence or excess of zeal on the part of the patient may lead to error. From what I have seen of the methods of perimetric examination both in this country and abroad[1] I can assert that the mode of mapping out the field varies in every school. Some experimenters accepting a patient's statement as to what he sees "so as to save time", the patient all the while misunderstanding the application of the test. The results of others, were one aiming at collective examination, will be modified by the mode of examination, and

even

even by the instrument used, and it is necessary at the outset, before drawing any conclusions from the results of perimetry to determine a standard method of examination.

In this region of Ophthalmology my endeavour has been to map out the visual field in cases manifesting symptoms in themselves not always ocular, and to attempt to draw a conclusion from them. Most of the cases were patients attending the Glasgow Eye Infirmary, the remainder presenting themselves in the medical wards of the Western Infirmary, Glasgow. In all cases I have made the measurements myself, in a systematic manner so that no confusion might arise from the application of different methods.

It is difficult to speak of the value of

perimetry

perimetry for in the results one is at the mercy of the patient, but from what follows I hope to show its value in the diagnosis of lesions of the spinal cord as well as in cases which appear to indicate intracranial disease.

It is greatly to be regretted that in recent discussions on "Brain Surgery" the ocular condition was not more definitely described or investigated, and it was the omission of any mention of colour-perception or visual area in the discussion recently held on the subject under the aegis of the Glasgow Medico-Chirurgical Society that led me to follow up more closely what I had hitherto been doing as a matter of hospital duty. The discovery of the Ophthalmoscope has enabled us to see a nerve, an artery and a vein all in very close connexion with

with the central nervous system, and the importance of an examination of all the objective and subjective symptoms in every case of cerebral or spinal disease cannot be overstated.

The perimeter is a physician's instrument for it is in the diagnosis of such cases of nervous disease that its value would appear to lie. In ophthalmic hospitals the patient comes for advice about his eyes although ataxic or other symptoms may have been present for some time before, and he may be satisfied with one examination. The difficulties of following up such a case are great, and the patient's time does not allow of a lengthy examination with the perimeter. On the other hand in general hospitals, and especially in Infirmaries under the Poor-Law there are opportunities for special work of this kind, with the

In the latter case
the possibility of a patiently-expected autopsy.

The following cases are not solely those of spinal disease, but include cases of other affections in which peculiarities of the visual field are met with.

I shall begin by describing the method of examination and the normal field: then proceed to discuss those cases in which the state of the fundus explains the loss of a portion of the field.

These are, Separation of the retina, embolism of the central artery of the retina, retinitis pigmentosa, and glaucoma; after which will fall to be discussed those cases which, although they may show in the condition of the fundus changes which have become identified with visual defects remain for the most part unexplained by our ignorance of physiological or pathological states. Under this head may be grouped

grouped scotoma (whether toxic or dependent on other causes) and contraction of the field in cases manifesting morbid conditions of the brain and spinal cord.

Before.

1) de Wecker Landolt . op. cit. i. 592

Before proceeding to discuss those cases in which the Visual Field presents peculiarities differing from the normal standard we must first consider the method of pursuing the examination and the area which we accept as normal.

Landolt [1] defines the latter as that area in which an eye in a fixed & stationary position is capable of receiving luminous impressions. The limits of the visual field are defined by the most distant points from the line of vision which produce a luminous impression.

The earliest mode of mapping out the field was by means of a black board and a piece of white chalk fixed in a long handle. The patient fixed the eye under observation on a mark in the centre of the board

board, (the other eye being covered) while the chalk was moved towards the central mark. The furthest points from the centre at which the patient was able to see this white chalk, while the eye was still kept fixed on the central object, marked the extent of the field.

Obviously this gave only imperfect results till the labours of Aubert & Foerster evolved the principle on which all our present perimeters are constructed. This consists of an arc of a circle with a radius of from 12" to 18" inches, fixed on a stand with its concavity towards the patient and capable of being rotated round an axis which consists of the line of fixation, that is, the line drawn from the summit of the arc to the patient's macula. The arc is

marked

1) Strictly speaking the arc should be fixed so that the centre of the circle of which it constitutes a section should lie at the nodal point of the eye, i.e. a point at, or very slightly behind the posterior surface of the lens.

There is also a mathematical difference between the line of vision & the line of fixation but for present purposes it may be assumed that they are identical.

marked off in degrees, zero being directly in front of the patient and 90° at the peripheral extremity of the arc.[1]

While the patient's eye is fixed at zero or the summit of the arc, (the other eye being covered) discs of various colours and sizes are moved along the arc from its extremity towards the line of vision, and that point at which the disc is distinctly seen, as well as the fixing point marks the extent of the field in the meridian in which the arc of the circle lies. From this it will be apparent that the limits of perception of the discs seen while the disc is opposite the outer (temporal) side of the eye will mark off the area of perception on the inner (nasal) side of the retina

and

and vice versa. The degrees noted on the arc are marked off on the blank-charts in the various meridians, and these points are connected with lines, giving the area desired.

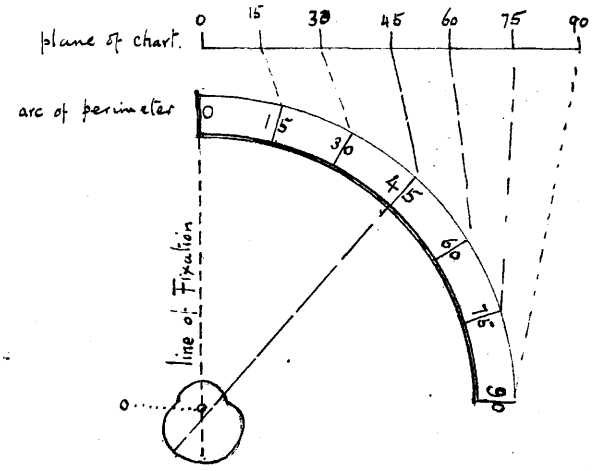
The arrangement of the charts here shown represents the fields as they appear to the eye of the patient or of anyone else, and it must be understood that the area to the right side of the right eye is called the outer or temporal side of the field tho' corresponding to the inner or nasal side of the retina. The area to the left hand side of the left eye is the outer or temporal side of the field, corresponding to the nasal side of the retina.

This system causes a little confusion

to

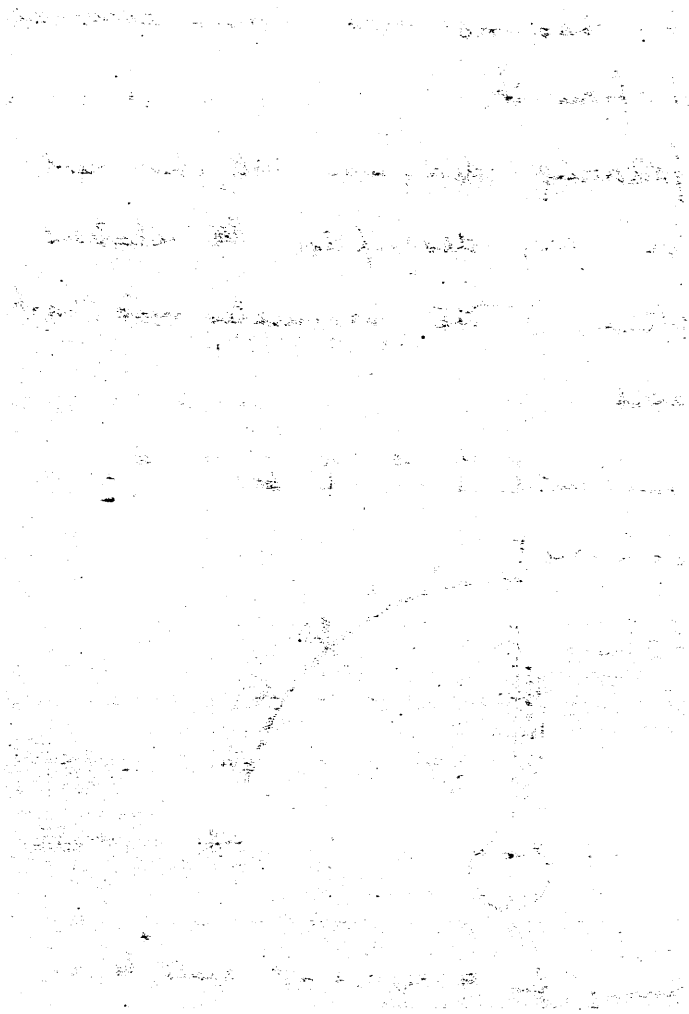
one unaccustomed to study this subject, but as it is the method employed by all observers it has not been found convenient to depart from it.

The following diagram will show more clearly than any description the relations of the retina to the perimeter and chart for all axes.



The line running from the eye to 45° should be represented further towards the cornea, viz: at o

1) de Wecker & Landolt. op. cit. i. fig 139.



The field given on Plate I represents the minimum normal field according to Landolt [1]; green having the smallest area, white the largest, while red and blue occupy an intermediate position.

The faint red line marks the normal limit for white according to McHardy.

The centre of the field, or zero marks the point of fixation and corresponds to the macula. The small circle about 15° to the outside of, and slightly below, this point marks the position of the optic nerve relative to that of the macula. In the normal eye it will be seen that the extent of the field is not equal in all directions from the macula but forms an ellipse whose major axis lies nearly directly downwards and outwards.

The agents which give rise to this apparently

apparently, want of symmetry must be recognized to prevent such an extension of the field to the temporal side, and contraction to the nasal side being mistaken for a pathological condition. These are, the lids, the soft parts of the orbit, the nose, the size of the pupil and the refractive condition.

Of these which are extra ocular, a drooping upper lid will limit the upper area of the field, as a prominent cheek bone will have the same effect in the lower and outer parts, while a highly-bridged nose will diminish the area towards the nasal side, all of these agents acting as screens, by interfering with the rays of light which emerge from the object and proceed to the retina.

A Smale

1) de Wecker. Landolt. p 615.

A small pupil will also diminish the angle of rays entering the eye and give a limited field. Further, in hypermetropic eyes the field is larger than in those which are emmetropic, and still more so in myopic cases.

It has been sought to explain the fact of the field being smaller to the nasal side than to the temporal, by arguing that the projection of the nose, by cutting off rays of light passing to the outerside of the retina rendered that portion of the fundus insensitive to visual impressions from want of use, the same argument applying to the other parts of the field which are overshadowed by the orbital parts — as Landolt calls it [1] "une espèce d'amblyopie par anopsie."

The same

1) A.H. Griffiths on "The Field of Vision", Medical Chronicle november 1885. This argument was put forward by Landolt some years earlier in a paper entitled "Il perimetro e la sua applicazione" Annali d'Ottalmologia. milano. 1872. p. 12

2) de wecker Landolt. op. cit. p 615.

The same observation is made by Dr. A. H. Griffiths [1]. He says that "the facial prominences, have, I believe, by their presence caused certain parts of the retina to become functionless from disuse."

Donders [2] as well as other observers have remarked that the nasal side of the retina, that is, that part which receives luminous impressions from the temporal side, extends further up towards the lens than the temporal side of the retina. The difference between the two sides is from 0.50 to 2.00 millimètres, corresponding to an arc of 12 or 13 degrees. Landolt is constrained to confess that in spite of this difference between the two sides of the retina, a portion of the retina to the temporal side still

still remains insensitive to luminous impressions.

An instrument however has been devised by the Waltonian Lecturer to this University, which demonstrates that the nasal side of the field is nearly as large as the temporal, and that the difference would be accounted for by such a state of matters as Donders describes.

In this ingenious instrument, the most complete and exact perimeter yet invented, the fixation and moving object are the same. The measurements are made by means of a rotating double-image prism, in which, held close to the eye, apparently a moving object, the reflection of the fixed object is seen. The area can thus be estimated in all directions independent of any obstruction to the luminous rays from projecting

projecting adjacent parts. With this perimeter I have taken my own fields for green and red and they are represented on Plate II. The colours were obtained from a spectrum-grating, 2·80 centimètres long and 2·00 cm. broad. The size of disc was thus six times larger than those given on plate I, and about twice the size of those which Landolt employed for measuring the normal field given on the latter plate. In this instance however the size of disc does not alter matters; the only relative point to be noted is the size of the fields to the temporal and nasal sides. In my own case it will be seen that in the right eye the field extends equally on all sides round the fixation point. In the left eye the field to the temporal side is larger than to the

to the nasal side. For green it is one-fourth wider, and for red two-fifths. This, however is a comparatively slight increase in area taken with the minimum normal fields on Plate i. These show that the limits outwards, and outward-and-downwards are nearly double and at times more than double the upward, inward and downward limits.

In other cases (not here recorded) it was found that, with Dr. Reid's instrument, the areas appeared circular in shape, with their centres fixed at zero. This would appear to show that the upper, lower and temporal sides of the retina are not altogether functionless, although from their not being employed in direct vision it is natural to conclude that their receptive faculty is less acute than

1)

The trade names of the types used on Jaeger's Scale are the following:

No 1.	Brilliant.
2	Pearl.
4	Minion
6	Bourgeois
8	Small pica
10	pica
12	Great primer
14	Double pica
16	2 - line Great primer
18	Canon
19	4 - line condensed.
20	8 - line Roman.

that region which directly receives luminous impressions.

The fields are mapped out on charts designed by Professor McHardy for his self-registering perimeter. Those having the meridians printed in light red give the fields on half the scale of those printed in blue. The latter charts are used to show more plainly the exact disposition of very contracted fields.

The squares of colors on plate I have a side equal in length to one centimètre and in every case it is to be understood that discs of exactly the same size and shape and colors were employed except in isolated instances which will be mentioned. In all cases where the vision was above no 16 of Jaeger's (i.e. N°14, 12, 10, etc.) [1]

test-types the limits of the areas were not marked on the chart till both the shape and colours of the disc were recognized.

When the vision was only 16 Jaeger or 18° (letters of large size, from 3/8" to 1" in height) the points were marked at which the colours only was recognized. The perimeters used were those of Badal and Blix. Both have the disadvantage that the fixation-object is at a distance from the eye, requiring relaxation of accommodation, while the travelling object is about twelve inches from the eye requiring (when it approaches the centre of the field) accommodation to see it clearly. Measurements of the field in the same eye made with both instruments were found alike, so that no allowance need be made

made for the particular persons used.

All of the cases have been measured by the same standard, so that for purposes of comparison it is not necessary to take into account the method followed. For comparison, on the other hand, with the results of others, it would be necessary, as has already been said, to take into consideration these apparently trivial details of the mode of examination.

Separation of the Retina.

The field of vision in separation of the retina is as a rule so characteristic that the diagnosis may be made from it alone, without ophthalmoscopic examination. The field shows a defect of the upper half, or of sectors which are clearly demarcated. The field may also appear irregular in shape, and bounded by a line which does not take the shape of a curve, but rather runs in an angular manner, dipping suddenly towards the fixation point, and again suddenly extending outwards. The blank area of the field

field corresponds to the detached portion of the retina. The defect of vision is often noticed by the patient himself, his statement being that he can only read print by holding the paper in a particular direction, either sideways or below the horizontal, and this is accounted for by the characteristic appearances of a separated retina seen on ophthalmoscopic examination. As in most cases it is fluid beneath the retina that causes it to be detached it is to be expected that from gravitation the lower part is bulged forward. This is not always the case at the outset, but ultimately it comes to be so, the field showing a deficiency in the corresponding upper portion.

In Case 1. plate iii. A. (Patrick S.) this deficiency of the upper part of the field is clearly shown by the

by the red line. There is also lateral contraction. The black line shows a slight improvement in all directions, a fortnight later.

Case 2. Plate III. B (William C.) The black line shows the field on admission with loss of vision to the upper and inner side. The blue line shows a general extension of the field: the red, a relapse to what it was on admission: and the green, (on dismission after a stay in hospital of 4 weeks) a wider field, but still showing the separation present.

Case 3 Plates IV & V. (Andrew F). This patient first noticed his sight failing after receiving a blow on each eye about a year before he presented himself at the Infirmary. The sight was very defective; with the right eye he was only able to see the largest letters

Jaeger 20, and 18 J. with the left. In the right eye there was a separation at the lower part of the fundus - a cicatrix in the upper part of the choroid; patches of choroidal pigment disposed in rings with atrophic areas in their centre were seen in the macular region and at the upper part of the fundus.

In the left eye the same condition was present, the separation larger and more marked.

The field for the right eye (plate IV. A.) shows a deficiency at the upper part with concentric contraction. A ring shaped scotoma is situated in the centre of the field, occupying the optic-nerve and macular region. A fortnight later (C) it is no longer ring-shaped, but still remains for the most part central.

A month later (Plate V. E) the scotoma is no longer

present, but there is a marked deficiency of the upper part of the field.

The field for the left eye (Plate IV. B-D, and V. F) show a central scotoma which gradually passed off. The field became relatively more extended, but at best showed contraction.

Owing to the amblyopic state of the macula fixation was made with difficulty, and could only be approximately obtained by watching the patient's eye. In E. Plate V. the central point should properly lie at 10° in the vertical, downwards, and in F, at 10° horizontally outwards.

In Case 4. (Plate VI, A-B.) Many A, is shown the visual area in a case of high degree of myopia with separation of the retina and consequent choroidal changes.

changes. The angular nature of the boundaries of the field is due to the sub-retinal fluid occupying wedge-shaped spaces, pointing with their apices towards the nerve. In this case there was great choroidal atrophy with the pigment collected in large patches.

In Case 5, (Helen T. Plate VI. C & D.) the ophthalmoscopic examination showed, in the right eye, the nerve pale, and the vessels small — atrophy of the choroid round the disc, and the pigment collected in patches.

The vitreous was muddy and the lens cataractous at its lower margin. The retina was separated apparently all round.

In the left eye the disc was hazy and there was a large separation of the retina at the lower part. The fields for the right eye show

that while the separation, on the first measurement (black line) was all round the fundus, it had come to occupy the lower part, when the second measurement (red line) was made. In the left eye (D) the separation present at the upper and outer part of the retina (as shown by the defect at the lower inner region of the field, but not made out on ophthalmoscopic examination) had disappeared on examination later on (red line) and the large separation at the lower part was less, as shown by the difference between the red and black lines in D.

Cases 6 and 7 (Jas G. Plate VII B, and Alex C. Plate VIII A) are those of separation of the retina. In the former it was large in extent, and easily seen. In the latter it was

it was only made out by carefully focussing the retinal vessels with a refraction ophthalmoscope.

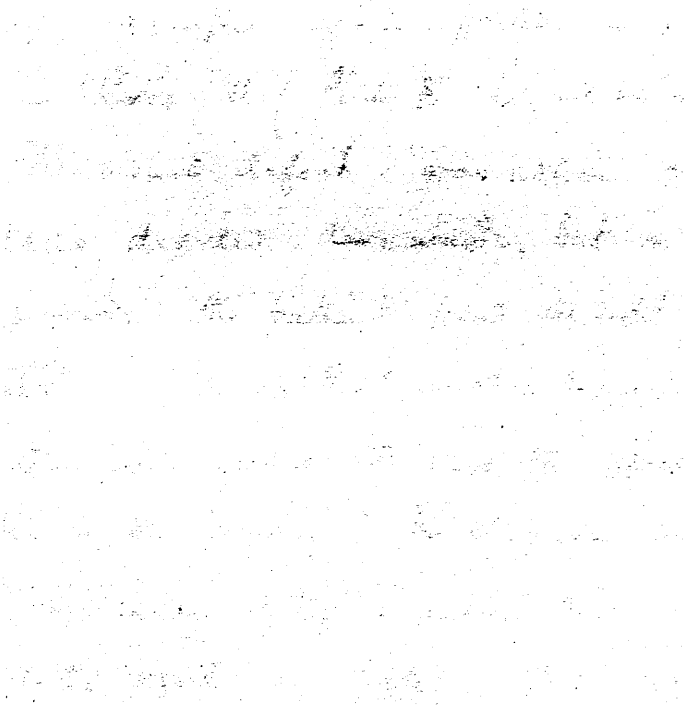
Case 8 (Thos F. Plate VII. A) shows the field in a case in which there was divergent strabismus, and an optic neuritis present. This state of the error led to a field being taken, when it was found that the inner half of the field was defective. On dilating the pupil widely with Atropin a separation of the retina was seen in the lower and outer quadrant, limited to the extreme periphery, and not approaching the nerve. There was exudation on the retina of a stellate form, the surrounding part being pale.

In case 9 (Wm McK. Plate VIII. B) a separation of the retina was seen on ophthalmoscopic

Ophthalmoscopic examination. a cicatricial streak was present, situated at the optic-nerve entrance. There was a history of a blow on the eye some months previously. At the same time it would appear that a toxic element was present, as there was a central amblyopia for white, and colours, except yellow, and he smoked three ounces of tobacco weekly. The central scotoma might be due to changes in the retina and choroid consequent on a rupture of the latter membrane, as indicated by the cicatricial streak, or to the central blindness of amblyopia nicotiana.

Case 10, (Plate IX. B. Francis (at the lower part) M.C.T.) shows a large and almost complete operation which had been overlooked on ophthalmoscopic examination, and was discovered

discovered when the field was taken for another purpose.



Embolism

Embolism of the Central Artery of the Retina.

A single example of this affection is given here – Case 11 (Plate X. Lizzie the C.A.)

The visual defect was noticed on the eye being directed downwards, but on looking upwards the patient found the sight unimpaired. On ophthalmoscopic examination the fundus was found to have the appearances depicted in the drawing. The plug was seen at the bifurcation of the ascending artery. This portion of the vessel was pale, and its calibre within the angle formed by the branches could not be defined.

defined. A haemorrhagic spot was seen to the temporal side of the fundus (right hand side in the drawing) lying above the macular region, which, as the field shows was not involved. The field shows exactly the area of loss of vision. About four weeks later the exudation (the greyish pink area) had disappeared, but the plug still remained in its former position, and the artery had a whitish appearance. The field remained the same. There was a history of rheumatism, and the cardiac action was irregular. But no murmur was detected.

Retinitis

1) G.A. Berry. "Subjective symptoms in eye diseases." p 96

Retinitis Pigmentosa.

An extreme degree of concentric contraction of the visual field is generally accepted as pathognomonic of this disease. Indeed the visual field has such definite characters as, to use Berry's[1] words, "to render an ophthalmoscopic examination almost superfluous."

The fields in two cases are shown on Plate XI. In Case 12 (Peter R. A and B) the visual acuity was greatly reduced, being for the right eye one-fiftieth, and for the left eye one-hundredth of the normal. The condition of the fundus showed the characteristic

characteristic appearances presented by this disease. The periphery of the retina was sprinkled with black patches of pigment, stellate in form, and constituting a zone which did not extend up to the nerve. The patches of pigment appeared to lie over the vessels, showing that they were in the retina and not in the choroid. The vessels were diminished in size and the optic discs were of a waxy, pale colour.

In Case 13, plate XI. C ↦ (Euphemia McI.) the visual acuity was nearly normal, in spite of the great concentric contraction, a characteristic condition in the disease. The state of the fundus was the same.

The disease is believed to be hereditary and is said to occur in the offspring of parents who are

who are blood-relations. In two other cases the parents were first-cousins. One of the patients was a young man of twenty-seven years of age — dull in intellect, and deaf. Neither of them was able to comprehend what was required of them for the application of the perimetric test, and therefore it was impossible to take their fields.

[This disease is mentioned because it presents a defect of the visual field. It is not my present intention to give it other than a passing notice, and the same remark applies to the notes on the following disease.]

Glaucoma.

Glaucoma.

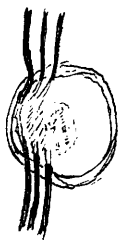
Three cases are here presented, all of which show the characteristic limitation of the visual field to the nasal side described by A. von Graefe.

The fields on plate xii, A and B, are those of Margaret Mck (Case 14) who complained of great loss of vision of the left eye, with which she was only able to see the largest letters when held towards the outer part of the field. The vision of the right eye was giving her no concern. For the last six months she had been seeing halos surrounding bright lights. The left pupil did not react to the stimulus of light. The corneal sensibility was unimpaired. On ophthalmoscopic

Examination

examination the right nerve was found to be pale in colour, and slightly cupped. The nerve of the left eye was greyish in colour, and deeply cupped. It was surrounded by a white ring of atrophied choroid, and the vessels emerged from the nasal side of the nerve. The vitreous was also muddy.

[Diagram of the glaucomatous cupping in this case]



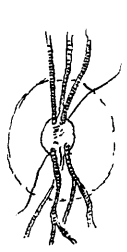
The tension was not increased.

The fields for both eyes show markedly the retraction of the ~~field~~ area on the nasal side.

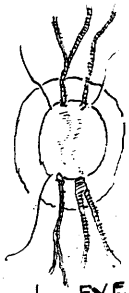
In Case 15 (Plate xii. c. D. James B.) the same condition is present. The vision of the patient was nearly normal, but the subjective symptoms of mists and fogs appearing

appearing round bright lights, were complained of and the tension was increased.

The peculiarity of the state of the optic nerves, however was that instead of glaucomatous cupping being present an extreme degree of congenital cupping was seen, more extensive in the left eye. and the limitation of the field to the nasal side was proportionate to the extent of the cupping.



R EYE



L EYE

A comparison of these diagrams with the preceding will show that while the vessels in the former case appear to emerge from the edge

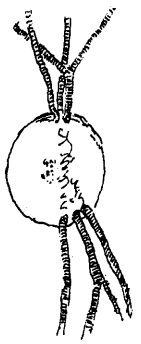
edge of the disc, in this case a ring of nerve intervenes between the central cup and the edge of the disc.

The details of Case 16 (Plate XIII A & B) Henry B. are somewhat similar to those of Case 14. The vision was fairly good (No. 2, Jaeger's test-types when aided by convex glasses to correct the presbyopia). The failure of vision was noticed nine months before advice was sought, and the fogs & dark rings were complained of.

It was noticed that the central vision of the right eye was lost. This is represented on the chart (A.) by cross-shading, and the dividing line lies almost in the fixing line. Fixation here was difficult owing to the central scotoma, and it is probable that the

centre of the field A should be 10° to 15° to the outside.

The tension in both eyes was increased. In the right eye there was glaucomatous cupping, with the vessels lying near to the nasal side of the nerve, which was of a pale colour.



[Glaucomatous cupping in the R. eye of ~~Henry~~ B. case 16.]

The media were hazy and the corneal sensibility was somewhat diminished.

The outline of the left disc was irregular, but there was no cupping. The field, however, was diminished to the nasal side.

Scotoma

1) Wörterbuch der Augenheilkunde. Leipzig. 1887.

2) Subjective symptoms of eye disease. Edinburgh: 1886. p. 93
v. inf. note to p. 57

Scotoma.

Hirschberg[1] defines a scotoma as a "behaarliche "verdunkelung" (behaarliche is untranslatable) or a "circumscribed area of the field of vision. For "instance central scotoma = deficiency of the "centre of the visual field. Probably discovered "by Sichel (Littré's Dictionary p. 1359) and intro- "duced by A. von Graefe (Arch. für Ophth. vol. "ii. part 2. p 258), and shortly after generally "adopted."

Berry[2] goes further. He says Scotomata "are usually divided into positive and negative, ac- "cording as they give rise or not to a consciousness of the interruption

[1] op. cit. p. 94.

'interruption. In the one case there is more or
'less perception of darkness, in the other an
'entire absence of any visual impression.'
(And again!) "When a lesion primarily involves
'the nerve fibres of the retina the resulting scotoma
'is unperceived, or negative. When, on the other hand,
'lesions involving the retinal pigment and choroid and
'the cause of the defective area, there is more or less
'consciousness of its presence'.

The following cases give examples of both varieties. It is a symptom in many diseases, in which it may be difficult to connect it with the ophthalmoscopic appearances presented by the fundus. Indeed the state of the latter may be described differently by separate competent observers. In Choroiditis disseminata, where the seat of the disease lies for the most

most part in the macular region the Scotoma is present in positive form, and the patient may direct the eye sideways at an object so as to see it. In case 17 (Plate XIV. Joan B.) this condition was present, a visible lesion sufficient to account for the loss of the central portion of the field. Apart from such cases as this the great majority of cases of central Scotoma present no definite lesion of retina or choroid or optic nerve. Retinal and choroidal changes may be identified, but it is impossible to say, on looking at an optic nerve that a Scotoma will be found present.

In the absence of other signs the name of "retro-bulbar neuritis" has been given to such affections of the optic nerve as may give rise – inter alia – to central Scotoma.

1) Mackenzie. "Diseases of the Eye". 3rd Ed: 1840
page 888.

2) London Hospital Reports. 1864.
"On the prognosis of Tobacco Amaurosis." Ophthalmic
Hospital Reports. vol VIII. pt 2. p458. 1876.

Fifty years have elapsed since the Father of British Ophthalmology, in his classical work on "The Diseases of the Eye" [1] expressed his opinion that "one of the narcotico-acids, which custom has foolishly introduced into common use, namely tobacco, is a frequent cause of amaurosis." Twenty-five years later Hutchinson [2] adduced evidence to show that smokers or chewers of tobacco suffered from a particular form of amblyopia. Since then the affection has been generally recognized by ophthalmologists. The statistics of the Glasgow Eye Infirmary show the proportion of cases (in the years 1885-6-7) to be three in one thousand cases of all the diseases of the eye. I am inclined, however, to believe that in many cases the tobacco-element has been overlooked, and that "Neuritis" has been regarded as sufficient diagnosis.

Although

1) Traité complèt. by de Wecker & Landolt. vol IV. p 457

2) Nettleship (Diseases of the eye. 3rd Ed. London. 1884. p. 367) quotes the opinion of Hutchinson that "probably alcohol in very "moderate doses counteracts, rather than increases, the injurious ef- "fect of tobacco on the nervous system and optic nerves."

3) Griffith "on the Field of Vision." Medical Chronicle Nov. 1885.

the existence of tobacco amblyopia is not denied, the influence of the weed alone in producing the affection has been questioned. De Wecker [1] says on this point that 'it is alcoholism plus the abuse of tobacco 'which produces this toxic amblyopia', and he gives his experiences in Cuba in support of this view. He says the tobacco amblyopia is unknown among the inhabitants of the Island, who consume large quantities of tobacco. The defect is only noticed among those in good society who may spend some time in England, where they 's'accommodent 'aisément à l'absorption d'une quantité de 'liquides alcooliques.' [2]

Griffiths [3] gives it as his experience that 'Tobacco alone can, and does give rise to this 'form of amblyopia', and that it is 'as well 'established a fact as any in the whole range of 'ophthalmology

ophthalmology.

I have had no opportunities of meeting with cases of this form of amblyopia in others than of the lower-middle and lower classes, and my experience is thus restricted. But I would conclude from the cases that I have seen, that it may appear in those who smoke an immoderate amount of strong tobacco, without alcohol; that it may be developed in subjects smoking a moderate amount of strong tobacco, or, when they are not smoking, chewing an equally potent form of the weed, without regular meals to balance the effect of the tobacco; that those most favourable to the attack are working men who begin their day with a smoke, who smoke heavy tobacco on an empty stomach, and whose regular diet consists of spirits, tea, salt fish or salt meat, without

without the intromission of a good solid meal.

The cases which are here given are taken at random as they presented themselves at the Dispensary of the Lying Infirmary, and in one case only did alcohol play an important part.

I have frequently smoked more than an ounce of tobacco a day but touched no alcohol in any form, and yet I have experienced no visual impairment, although I have been engaged at work which certainly would have made any defect apparent. The immunity I have enjoyed must be attributed to the counter-effect of judicious meals on the tobacco, and to a light form of the weed.

As to the explanation of the negative scotoma that is, one primarily involving nerve tissue, the isolated cases in which a microscopic examination of the

1) Trans: Ophth: Soc. vol i. p. 124. 1881.

2) Centralblatt für med: Wissenschaft. vol 18. p 417.
Berlin. 1880.

of the optic nerves was made, showed changes in the axis of the orbital portion of the optic nerve.

This has been found by Nettleship and Edmunds [1] in a patient suffering from diabetes, who was also a heavy smoker, and by Samelsohn [2], in a case of central amblyopia, to consist of "a tract of 'chronic interstitial inflammation and degeneration 'extending from the optic foramen, where it was central, to the eyeball, where it occupied the outer 'part of the optic nerve'. And this has been confirmed by others. That the inflammation is interstitial is shown by the fact that, in tobacco cases, the giving up of tobacco, is followed by recovery of sight (in recent cases at any rate, where the patient seeks advice as soon as the visual defect is noticed), altho the inflammation if long-continued may so injure the nerve fibres

by pressure

1) In estimating the presence of a central scotoma with the perimeter some observers employ a smaller disc when moving the "traveller" toward the centre of the field. For the present purpose it was not considered necessary to do this, as the test with the dots is a certain one. Further if the disc is to be diminished in size as it approaches the centre, it must do so gradually from the periphery, even for normal cases. I can conceive of this being possible with that kind of diaphragm ("iris diaphragm") used for microscopical purposes, where aperture, by moving a pivot in a slot, can be made to increase or diminish concentrically. It would not be a difficult matter to attach such a "movement" to a perimeter like that of Bliss, for instance.

by pressure as to damage them permanently.
As to the symptoms which give rise to the suspicion that tobacco is to blame when a patient complains of dimness of vision, the primary one, or one of considerable importance is the patient's statement that his sight has become suddenly worse within a few weeks, and that he is now unable to read the newspapers. Beyond this little else is complained of, save perhaps headaches, and both eyes fail nearly simultaneously. On being applied a colour test, (the ones in use at the Glasgow Eye Infirmary are shown on plate i) he is probably unable to tell correctly the green or the red. This w? be the case in a severe form of the disease. More likely is he unable to see the dots on the cards[1] respectively 4, 3, and 2 mm. in diameter, although he is able to tell the colour when he sees a large area of it. It is our this fact

fact that the patient can tell a colour correctly when he sees a large area of it, but fails to see it when a minute area is presented to him on ~~which~~ that the diagnosis rests. With the ophthalmoscope no abnormal feature of the fundus may be detected. The disc may appear to different observers to be normal in colour. The vessels, however, may appear to have lost their reflex, giving rise to a rough ~~outline~~ outline, and the veins may seem to be darker in tint. The diagnosis may be made before asking the patient if he smokes, and the improvement that follows in the course of a month or two after the total discontinuance of the habit establishes without doubt the cause of the impairment of vision.

On plate

On plate XV (Case 18. Jas McG.) are shown the visual fields in a case of tobacco amblyopia, and the improvement which took place after smoking had been stopped. When he first presented himself (in July, 1887) his vision was so impaired that he was only able to read No 14 of Jaeger's Test Types at a distance of 6 inches, aided by convex glasses.

The dimness of vision had come on six months before, accompanied by frontal headaches. At this time, and for the preceding two years he had been smoking four ounces of black twist tobacco per week. On ophthalmoscopic examination the right optic nerve appeared hyperaemic to the nasal side, and pale to the outer side. In the left eye the nerve was of a greyish pink appearance towards its inner side, and its margin was ill-defined, while the outer side was pale. In both eyes the veins

were increased

1) When the travelling disc seems to go out of sight completely the scotoma is <u>absolute</u>; when it appears to change colour, and is still seen it is <u>relative</u>. This phenomenon may be present either in the <u>positive</u> or negative form. v. ante. p. 46.

were increased in size, and those in the left eye were tortuous. On taking the fields in the right eye the areas for white, blue and red were fair in extent. That for green was also satisfactory, but from a little below the fixation point upwards the disc appeared to the patient to undergo changes of colour. at the periphery it appeared blue, a little further toward the centre it was called green! [1] It gradually became paler till it disappeared altogether in the centre. Below the point of fixation it was again seen, but the colour was not recognized till at about 20° downwards in the vertical. The scotoma was central, occupying the macular region, and did not extend to the region of the optic-nerve entrance. In the left eye the fields were more irregular, especially at the lower part where they gave the impression that a separation of the retina was present at the upper part

1) Although the areas in both cross and encroach upon one another I do not consider this an abnormal feature. The regular ovoid concentric line for all colours is to my mind significant of a normal field. The concentric accuracy of the ovoids on Plate I appears purely diagrammatic. I have never seen it.

part of the fundus. No such condition, however, existed. There was an absolute central scotoma for all colours extending from the macula to the optic nerve entrance. Five months later the vision of the right eye was still the same, viz. 14 Jaeger's Types. The left eye had improved to that with it No 4 Jaeger could be read. Smoking had been given up, and a mixture containing the Bromide and Iodide of Potassium had been regularly taken. He now complained of numbness of the hands, and vague pains in the loins. If any alteration was present in the knee jerk there was a slight tendency to exaggeration. The equilibrium was normal. Three months later (in March, 1888) the vision of both was greatly improved, (R = 4 J: L = 2 J) occasional numbness of the hands was noticed, but the lumbar pains had almost gone. The fields (Plate XVI) were normal.[1])

In the

1) The patient continues to improve. June. 1888.

In the left eye the sector-like defect at the lower part of the field was no longer present. There was no scotoma, but the perception for green was still impaired, the disc to the right eye appearing yellow, and blue to the left, the blue disc appearing green to this eye. The optic nerves were condensed, white and well defined. The veins in the left eye were small.

The almost complete recovery of the sight, disappearance of the scotomas after the stopping of smoking are the grounds for the diagnosis. The patient was a strong man, temperate in all things except tobacco, and his history was good.[1]

The appearance of the nerves after 9 months of treatment showed the extent of the damage done by heavy smoking.

Had the patient stopped the habit as soon as the vision began to fail it is probable that the nerves would have completely recovered their functions.

Case

1) a private patient of Dr Samson Gemmell who kindly gave me details of the history. Dr Reid saw the case in consultation and asked me to measure the fields.

Case 19, Kenneth S.[1] (Plates XVII and XVIII). This patient suffered from great impairment of sight and loss of colour perception from tobacco amblyopia. He was 30 years of age, in robust health leading an active life in the Highlands. Till April or May 1887 his vision was excellent. He was a "marksman". At this time however he began to suffer from pains in the occipital region, accompanied by a feeling of heaviness in the head, and the vision began to fail. All his life he had been a heavy smoker, using tobacco of all sorts, at times smoking heavy black twist when he could get nothing else, and he was advised to give this up, the result being that the pains disappeared, but the vision remained unaltered. The physical examination revealed nothing to throw light on the loss of vision – there were no signs of cerebral or

Spinal

spinal implication. With the vision reduced to 1/20 of Jaeger's Test-Types it was to be expected that the fundus wd. show changes to account for this. Nothing, however, abnormal was seen in the nerves, beyond slight pallor at their outer lower margins, and an increase in the number of their vessels. On taking the fields (the limits show the latitudes at which the discs were seen, no account being taken of size or shape or colour) a central scotoma was found in both eyes. In the right eye for white and blue (plate XVII, A & B) the scotoma was both absolute and relative. For red (C) there was not only an absolute & relative scotoma in the centre, but also isolated scotomata dotted over the field. In addition to this the whole colour area showed peculiarities which are brought out by the various tints of the chart. For instance, in the longitude of 135° to the right hand (outer) side the moving

red

red disc was first called white, then it disappeared; then it appeared white again, then red (in latitude 55°). At latitude 35° to 30° it vanished for a moment, then reappeared as red, while from latitude 20° inwards it appeared as red gradually shading into pink, till at the centre it seemed white. The black areas show where the disc seemed to go out of sight, the grey, where it was called dark, but still was seen, the white, where it was called white.

The appearances presented by the green disc are shown in D. Plate XVII, and D plate XVIII. It will be seen that the areas where it appeared to the patient to approach most nearly its actual colour are in the horizontal line, the rest of the field, in the right eye, appearing yellow or white, and in the left eye, white alone.

I have

I have not had a further opportunity of examining the fields, but Dr Gunnell tells me the vision has improved greatly from the disuse of tobacco, and the employment of the continuous current. At the last examination of the fundus, by two independent oculists, the nerves were found to be normal.

In case 20. George McC. (Plate XIX) is shown the effect of the red and green on certain parts of the retina in toxic amblyopia. The vision was 16 J. vix, and he smoked from two to three ounces of tobacco weekly. He also indulged in alcohol. The nerves were in a state of incipient atrophy with choroiditis. This is the solitary patient whom it has been my good fortune to examine while almost under the influence

the influence of drink. The patient was of a better class than is generally met with in Dispensary practice, and was seen in this condition the night before I examined him with the Perimeter by a medical student attending the Infirmary. The state of the field confirms what is met with in cases in which a poison, not necessarily alcohol or tobacco is met with in the blood. In Uraemia for instance, in gout, and in dyspeptic states the colour vision is altered, and artists copying pictures while suffering from a bilious attack sometimes discover that, after recovery, what appeared to be a faithful copy is false and crude in colouring.

In this case (20) there was an absolute Scotoma for blue and white (Plate XIX. A) while the disc to the patients eye appeared to undergo

Changes

[illegible]

[illegible]

[illegible]

Changes of colour in certain regions. Red was seen chiefly in the lower and outer parts of the field, the rest of the area appearing either orange or pink. Green seemed to be distributed in zones, the colour being most uniformly recognized in the same area as red.

When in Paris in October, 1887, I examined many hundreds of charts of the visual field in the Cliniques of Landolt + Meyer, and found nothing resembling this case. This may be due to the length of time occupied in making the examination. As far as printed records are available, and in the numerous cases which I have examined, I have never met with a parallel case, although a case will has been described [1] in which certain areas of the fundus was influenced by red and green, while the rest of the field remained non-sensitive. This condition

appears to have been a temporary one, my reason for saying this being that it has not been observed by others, and in all probability it was caused by the presence of an abundant amount of alcohol in the man's system. The man never presented himself for a second examination, and I have been unable to discover his present address.

Case 21, John J. (Plate XXI) came to the Eye Infirmary complaining that a month previously he found himself unable to read; and that prior to this time a bright light dazzled the eyes. On the date of consultation he had some difficulty in distinguishing red and green. He smoked an ounce and a half of tobacco weekly.

The nerves on Ophthalmoscopic examination were somewhat ill defined in outline. The left was pink.

was pink. The perimeter showed the area for white and red fair in extent, that for green contracted. The red shaded area from the fixation point to the macula showed a region where red appeared yellow. This might be the normal scotoma produced by the disc, the perimeter being opposite the optic nerve entrance. The vision of both eyes at this time was 16 Jaegis Test types. About five months later the vision of the right eye was unaltered. That of the left was no 12, the vision being best in the evening. The nerves were noted as pale in colour with hazy margins; the veins were dark with rough reflexes. Blue, which could not be seen at all at the first examination was now seen distinctly. There was no scotoma for red, but there was a small one for green.

The shape of the fields A led me to suspect the presence

p. 88 + seq.

the presence of Spinal disease, but had this been the case I shd have expected to find the fields B assuming the shape which later on I shall show is characteristic of cerebral or spinal implication. No signs of tabes dorsalis were, however, present, and the shape of the fields B did not warrant my concluding that such a disease would ultimately make its appearance.

Case 22. See A (Plate XXI) shows the visual field in tobacco amblyopia with improvement a month later, after stopping smoking. In the right eye A green was not seen at all on either occasion for any meridian. There was no sensation for colours. In C, on the second examination of the right eye red appeared yellow on the disc of that colour approaching the point of fixation.

This might

This might be the normal Scotoma as in the preceding case. In the left eye a Scotoma was present for red and white. The area shaded green (B) indicates the only portion of the field which communicated impressions of this colour. A month later this area was larger, and in form hemianopic, the lower part appearing hazy.

Case 23, David O. (Plate XXII) was one in which dimness had only been noticed for a month before his presenting himself at the Eye Infirmary for advice. Before this time he had been able to read the newspapers with the aid of glasses, but at the date of the Examination he was only able to see No 16 Jäger with glasses to correct his presbyopia.

He smoked

1) after about an hour's interval.

He smoked four ounces of tobacco weekly. Tested with the cards on Plate I he called the green one bluish, but pink was correctly told. He was also able to see the spots on them.

The fields were fairly large in extent, and regular. No central scotoma was present but the green travelling disc appeared of various tints at different parts of the field indicated on Chart B. of Plate XXII.

Case 24 (Plate XXIII). In this patient the scotoma was made out by means of the test cards by one or two who examined him. Later on however on the same occasion he was able to count their number. The field was taken by lamplight, in which blue was not very distinct even to a normal eye. The fields were irregular,

There was a relative scotoma for green, and a relative and absolute scotoma for red.

Case 25 (Plate XXIV) has already been described along with the visual field in the Glasgow Medical Journal for April 1888. It is included in this section because of the specific symptoms present and for comparison with the case which follows. The symptoms were those of tabes dorsalis, but the extraordinary way in which they yielded almost at once to anti-syphilitic treatment justified the diagnosis arrived at by Dr McCall Anderson. The visual field of the right eye presented the sector-like defect which will be referred to in the next section. The optic nerves were implicated along with the rest of the nervous system, and probably there was here

was here the "axial neuritis" as described by Samelsohn and Nettleship and Edmunds.

Case 26 Fred. D. (Plate XXV) is one in which a syphilitic element was, as in Case 25, clearly present. He had been in the Navy and did not deny that he had had syphilis. The dimness of vision came on ~~four~~ ten years before, becoming much worse in the last two years, so that he was, at the time when he was seen, unable to earn a living. The scotoma was positive, and in order to bring the upper part (the sensitive part) of the retina into ~~play~~ use he turned the eyes slightly upward, so that the lower cornea-sclerotic junction was seen above the margin of the lower lid. He appeared to be looking upwards when in reality he was seeing objects

objects on the horizontal level of the eyes. Numbness of the hands was complained of, and pains in the back and loins were felt after exercise. The knee-reflexes were slightly exaggerated.

Both nerves were white, their margins hardly distinguishable from the colour of the surrounding retina. The choroid encircling the nerves was atrophied, and its pigment collected into patches over the fundus. The retinal vessels were very small.

The case was evidently one of syphilitic choroiditis with secondary implication of the nerves. A large amount of tobacco was smoked in the week, and might have been an element in the causation of the scotoma. It is highly improbable, however, that it alone could have caused so large a scotoma of positive nature.

On the plate (×××) the tinted area represent

represent the only parts of the retina capable of receiving visual impressions.

Case 27 Margt B. aet 16. (Plate XXVI) was one in which Syphilis was undoubtedly present. The scotoma was positive. On admission to the Eye Infirmary she stated that ten weeks before her sight became dim almost suddenly, getting worse in the week prior to coming to the Infirmary. The vision of the right eye was 2 of Jaeger's Types. With the left eye she was unable to distinguish the largest letters. She was in the third month of pregnancy. The heart was markedly irregular. She had goitre, and slight drooping of the left lid. The ocular movements however were unimpaired. The reflexes were normal, and there was no history of fits.

The Ophthalmoscopic examination revealed nothing.

nothing. The fundus was perfectly normal.

Some months later the patient was delivered of an illegitimate child complicated by a syphilitic eruption. The central scotoma is still present.

This probably was a case of axial (retro-bulbar) neuritis, an opinion arrived at in absence of other symptoms.

In Case 28 Samuel m.m. (Plate XXVII) the scotoma was about half the size of that of the former case. Here the nerves were atrophied, and the vision was reduced to no 20 Jaeger for both eyes.

There were no signs of spinal disease, and syphilis was denied. Tobacco and alcohol however could not be excluded, although the patients statement as to the abuse of these agents was of the usual kind, viz. that he always was temperate.

There was loss of colour vision, green being called grey when both eyes were tested separately, and this might point to tobacco.

The next cases are of a rare variety of Scotoma called "ring-shaped", and both occurred in men who never smoked.

Case 29. J. B. (Plate XXVIII) complained of dimness of vision (4 Jaeger) of 4 years duration. He was aware of the presence of the scotoma, and also that he could not see small spots of a red colour, altho' a large area was recognized. According to his statement this had always been the case. He never had Syphilis, had been intemperate, but never smoked.

The optic waves were of a blue colour to their outer side, and over the rest of their surface of a pale

of a pale colour. The vessels were small. The choroid was atrophied and its pigment collected in patches.

The fields of vision, taken on four occasions in three months showed, on three occasions (A, C + D) a partial or complete ring-shaped scotoma. Surrounding the fixation point, while in B, there was an absolute scotoma to the inner side, and a relative scotoma to the outer side of the fixation point.

The condition of the choroid was sufficient to explain the positive character of the scotoma, and the which always occupied the macular region.

In case 30, Wm. A (Plate XXIX) every thing was negative in the history. The dimness of vision only affected the right eye, with which only letters of no 20 Jaeger could be read, and had come on within in

within a months before admission. He was an abstainer from tobacco & alcohol. He was married never had had Syphilis, and his wife had not had any miscarriages. The reflexes were normal.

The field for the right eye was very much contracted (represented on twice the scale of the others in this section). For each colour there were isolated scotomata over the field, and both absolute & relative scotomata for all colours except green. The field for red shows portions where the moving disc was called white, as well as being correctly recognized, while there was a ring-shaped scotoma at the lower part.

The optic nerves beyond a slight pink infection showed nothing to throw any light on the case. I was only able to examine the patient upon this single occasion.

The following three cases were of atrophy of the optic nerves, with central scotoma and loss of colour perception.

In Case 31 John McG. act 26. (Plate XXX) both optic discs were blue in colour. The right was solid-looking and irregular in outline, and the vessels somewhat reduced in calibre. The atrophic condition was most marked in the left eye, the vessels here were very small. The dimness of vision was of a years duration, and at the time of examination was reduced to No 20 of Jaeger's Types. Seen indistinctly, with the right eye, and perception of light with the left. The dimness was described to the glare of gas, and the reflexion of light from linen, the patient having been a weaver. till vision failed. He was in the habit of smoking

[illegible]

[illegible]

[illegible]

Smoking four ounces of tobacco every week. Every Saturday night he drank two quarts of porter, and was drunk (presumably incapable) once every three months. Syphilis was denied.
His urine contained a trace of albumen, and pus. The specific gravity was 1025. There was a history of renal disease, but no cardiac complication was made out, nor was there any history of rheumatism. No symptoms of tabes dorsalis was present.

The visual fields showed in the right eye a contracted field with large central scotoma, and with loss of colour perception, as the chart A shows. This field also had its long diameter in the horizontal. In the left eye there was complete loss of the upper, and nearly complete loss of the outer & lower parts of the field. The colours

colours also was, as in the right eye, not recognized. The field looked like one of separation of the retina, but no such condition existed.

Case 32 Jas Mc A. (Plate XXXI) shows the fields in a case of positive scotoma. This also was a case of "blue atrophy", the nerves however being surrounded by a ring of atrophied choroid. This patient has attended the Eye Infirmary since March 1882, at which time the vision of the right eye was such that he could not see the largest letters (20 Jaeger). The vision of the left, with the aid of glasses was No:1. The outline of the right nerve was ill defined, and the nerve itself was pink. There is no note in the Journal of the state of the left nerve. In the right eye a central positive scotoma was present.

present. Two months later, in May, of the same year a central scotoma was present in the left eye. Presumably both nerves, therefore, were nearly in the same condition. No lesion of the retina or choroid was present, but still the scotoma was positive, the patient looking obliquely to see clearly. The patient described the scotoma in the last four years as varying in intensity and colour from a deep to a light grey. At one time it was ring-shaped.

In his history there is no ailment mentioned to throw light upon the case. It is however worthy of mention that twenty five years ago he received a severe blow on the lumbar region which, he says, nearly killed him, and this might account for the sensory disturbances which he has complained of. About a year ago he felt darting

pains

pains in the legs although these were present for a time when the sight began to fail four years ago. At the present time these pains have given place to a warm sensation. In addition, he says that while in the light he feels a numbness of the spine which passes off when he is in the dark, almost suddenly. Whether this is imagination or not is difficult to say. There is no disturbance of equilibrium, and the knee reflexes are diminished.

In order to take the fields large travelling discs were used, about two inches square, and the fixation was made by means of a clock face at which patient looked in such a way as to see its margins of equal size.

The scotomata were densest in both eyes towards the centre. The fields for red are shown according

according to the impression produced by the red disc upon his retinae. It will thus be seen that the only regions sensitive for red were those lying downwards and outwards.

On plate XXXII are shown the fields of this patient's brother who suffered from neuro-retinitis. He however had no scotoma. His knee-jerk was present, but he complained of feeling his hands asleep at night. James (Case 32) was very reticent about his brother, although neither he nor his brother confessed to any intemperance. Is it to be presumed that in the case of James there had been a neuro-retinitis going on to atrophy of the optic nerves? The positive form of the scotoma being positive from the first time the patient was seen would exclude the nerve being affected.

The persistence of red in this case is remarkable as being found in case 20 (page 63) and in the following: Case 33, Maxwell C. (Plate XXXIII). in which the fields for red in both eyes are shown (C + D). Here the nerves were greyish- in a state of atrophy. The dimness of vision was of a years duration. The reflexes were absent. The equilibrium was not disturbed when I tested it, but he complained of unsteadiness on rising from bed. He had also pains in his legs, and felt his feet asleep. The field for White (XXXIII. A) was good in extent. B, that for green shows the long diameter in the horizontal, with two relative Scotomata. The green travelling disc was called

bluish

"bluish with a white spot in the centre", when looked at directly. Obliquely it appeared as white or greyish. Over the whole of the field B the travelling disc was called white except at the shaded parts where it seemed grey.
Chart C shows the red field, with the colour persisting chiefly downwards and outwards.
There were two absolute scotomata for this colour, and at points the disc appeared dark red or grey or white as indicated on the chart. Time did not permit of an examination of the left eye for other colours than red, but here again the colour-perception seemed to remain longest in the horizontal or slightly downwards & outwards. This case is included in this section because of the scotomata although the shapes of fields B and D [illegible] to spinal

special implication as will be shown in the following section.

The Field

1) I prefer to take this name, as more comprehensive than "Locomotor ataxy" in that the latter is a symptom and that a late one of disease of the posterior columns.

2) Charcot: Diseases of the Nervous System: Second Series. New Sydenham Society. p. 35. (The italics are his).

3 Morbus

The Field of Vision in cases showing Symptoms of Spinal and Cerebral Disease.

The Ophthalmoscopic appearances of the Optic Nerve in Tabes Dorsalis [1] have been described as so distinctly characteristic that the a Subjective eye Symptom, the defect of Visual field, appears not to have attracted the attention which it wd appear, as an early sign, to deserve.

The nerves are said to present a definite appearance, such that, according to Charcot [2] they "enable "us to diagnose the ataxia, or sclerosis of the pos- "terior columns, if it already exists, or to fore- "see its advent, at a more or less early date if it "be not yet distinctly established."

It would be rash to accept this without a reservation for although

1) Gowers. Diseases of Spinal cord + nerves. p. 298.

2)
This word "neuritis" has caused much confusion. Ross in his work on Diseases of the Nervous System gives a Chromolithograph of a choked disc. (Stauungspapille) + calls it "optic neuritis." Likewise Powers. (Diseases of the nervous system. vol ii p. 125). In the Glasgow Infirmary it is the custom to call the choked disc "papillitis", or "acute optic neuritis", which neuritis is applied to a disc that is unduly hyperaemic but not swollen, nor prominent.

3) v. Discussion upon relations between optic neuritis + intracranial disease. Hughlings Jackson posting to him Cooper in support of this. Trans. Opth. Soc. vol i. p. 66. Does Cooper mean a hyperaemic disc or a genuine choked disc?

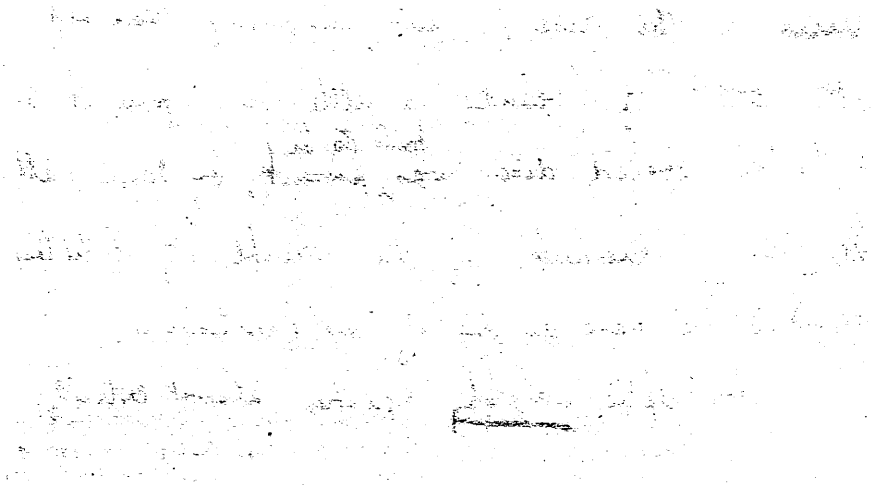
it is a simple matter, as in the first part of Charcot's statement, to "diagnose" from an examination of the optic nerves a disease which we can make out from other symptoms, it would be a hazardous proceeding to condemn a patient to hard ~~Symptom~~ anticipation of symptoms which, it has been asserted [1] do not appear after implication of the optic nerves.

An optic neuritis [2] is not invariably caused by disease of the cord or brain. It may come on in cases of ametropia [3], especially in astigmatism and in high degrees of hypermetropia. So that an observer careless of refraction-anomalies may diagnose grave nervous disease when rest and a pair of spectacles might have caused this "diagnostic" symptom to disappear. The converse is equally true, and cases occur to my mind in which, by careful

by careful focussing of the vessels ~~of the~~ on the disc, and comparing their refraction with that of vessels a little way from it, a veritable choked disc was found to be present, by some, although others, ignorant of the simplicity of the test regarded the case as one of astigmatism.

An optic atrophy signifies almost certainly a syndroma, or prodroma, or sequela of involvement of some other part of the nervous system. At the same time there are diseases of the nervous system, in which, in spite of a clear diagnosis of such, the vision may be normal and nothing pathognomonic of disease manifested in the condition of the fundus.

I do not attempt to disassociate an atrophy of the optic nerves from a nervous lesion elsewhere. At the same time being fully cognizant of the fact that it is difficult to describe, beyond generalization, and still



1) Uhthoff. (Archiv. für Ophthalmologie. 1881. vol 26. pt 1. p 277) says 50 per cent of primary optic atrophies are associated with disease of the spinal cord.
Galezowski, who has the advantage of examining the Salpêtrière cases, says in a recent number (about april/88) of "Le Practicien" 66 per cent.

2) Op. cit. p 27.

and still more difficult to detect optic nerve appearances, I have found great difficulty in recognising, in a large number of cases of affections of the optic nerve those appearances on which Charcot bases so much importance. I have seen them in two cases, one of Dr. McCall Anderson's and the other of Dr Finlayson's. In both the ataxic gait was well marked.

As a symptom all authorities are agreed that in tabes dorsalis atrophy of the optic nerves occurs in, taking the minimum figure, thirty per cent of the cases.[1]

As a symptom of diagnostic value Charcot,[2] and his opinion is rendered the more emphatic from the peculiar opportunities for research in La Salpêtrière – is able to record cases in which the optic nerve atrophy occurred some years before the other symptoms

1) Gowers: Diseases of the spinal cord nerves. p 298.

2) Buzzard: Diseases of the nervous system. p 151.

symptoms, and he believes that sooner or later cases showing progressive optic nerve atrophy and no other symptoms will develop into cases of tabes dorsalis. Gowers[1] on the other hand, whose labours in this particular sphere demand our respect and admiration – says of optic nerve atrophy that "it is generally an early symptom, usually commencing "before incoordination is developed; and in a large "number of cases ataxy never comes on, the final "malady becoming stationary when the nerve suffers. "It rarely begins after the gait is considerably disor-"dered".

A case is mentioned by Buzzard[2] in which optic atrophy was present with the Argyll-Robertson phenomenon, absence of knee jerk. There was also staggering noticed, but the evidence as to this is not clear as it was observed by an unskilled witness.

1) op. cit. p 152.

2) Bastian: Paralyses. Cerebral, Bulbar & Spinal. p 644.

3) Buckling: Diseases of the nervous System. p 219.

4) Ross: Handbook of diseases of the nervous System. p 515.

5) op. cit.

witness. The same author cites a case[1] which showed optic atrophy with disturbed colour vision, but no other symptom save absence of knee jerk in one leg + presence to a slight extent in the other.

Bastian[2] says "it sometimes shows itself very "early, + at other times only at later stages of the "disease."

Suckling[3] observes that primary optic atrophy may precede all other symptoms, even loss of knee-jerk, for years.

Ross[4] includes optic nerve atrophy in the pre-ataxic stage.

As to the shape of the visual field Gowers[5] says "the failure of sight usually commences "with a peripheral limitation of the field + loss of "colour vision, but sometimes the central acuity "fails early."

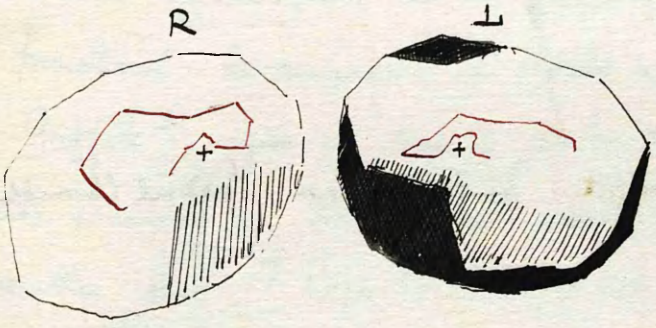
The same

1) Lecan Ditun.. p. 109.

2) Cf platiXL. L. eye. white fired.

3) Op. cit. p. 387.

The same author in his work on Medical Ophthalmoscopy[1] gives the field of an ataxic patient, and in referring to it says that sector-like defects may occur in simple progressive atrophy + spinal atrophy. As the shape of the field for red nearly approaches what I have found to be <u>almost an invariable condition</u> I reproduce his figure here.



[The shading represents amblyopia, the black loss. The red lines show the boundary of the field for red. Where it is absent the field ceased so gradually that its limit could not be ascertained.][2]

Bastian[3] says "The most common alteration in the visual field is a <u>concentric narrowing</u>, which, beginning at the periphery, may increase gradually until at last only a small

1) Op. cit. p. 388.

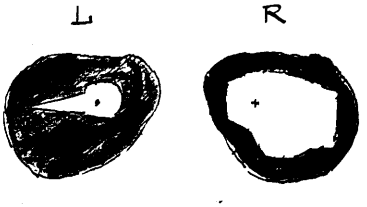
2) Op. cit. p 40.

3) A. Hill Griffith: The field of vision. Medical Chronicle. Nov. 1885.

a small central area is left." and again 1) "Sometimes the narrowing of the field from the periphery may proceed so irregularly as to lead to a sector-like defect: at other times one or other lateral half, or an upper or lower half, of the field of vision may be obliterated."

Charcot 2) points to concentric and unilateral limitation of the field as an important element in functional derangements of tabetic amaurosis.

Griffith 3) gives a case of "contraction of the fields occurring in ataxic case" which exactly (in L) resembles what I hope to show is not to be regarded only as an occasional occurrence.



But of the fields of vision which I propose to show

Shew under this section those cases which are taken in cases showing nervous disease other than spinal. Of these a complete diagnosis has not been made in each or every instance, but owing to absence of some symptoms, and presence of other signs in definite form same conjointly with the ocular condition, a strong presumption of cerebral or spinal implication has been arrived at. Unfortunately many of the cases have only been seen for a few minutes altogether, and the pressure of dispensary work has been so great that it has been impossible to enquire after other than leading points of diagnostic value. Many of the patients, although written for have never presented themselves for a second time.

Only one observer that I am aware of lays down a rule as to the definite disposition of the fields

1) Abadie: Leçons de Clinique Ophthalmologie. p 75 seq.
I quote from a thesis which I have made of this
paper.

fields in cerebral affections, namely Abadie[1], to whom I have already referred on page 4.

In a review of the eye symptoms of cerebral tumours he states that in the visual field the curves of areas present no characteristic, but the color areas show peculiarities. In simple atrophy the areas become reduced in size concentrically: in cerebral neuritis they cross + across one another.

The statement is one, which, as I have already hinted, may depend on the mode in which the perimetric examination is made, and if it is to be accepted as diagnostic almost every case ever recorded must be accounted one of cerebral tumour. The symptom, it may be urged is of value when the choked disc is present, but this condition of the optic nerve is generally accepted as almost diagnostic of intracranial mischief.

In the

[1] Traité Complet d'Ophthalmologie. de Wecker + Landolt, Vol IV. p. 533. I am responsible for the translation.

In the most recent work on affections of the optic nerve, from the pen of de Wecker [1] this author refers to the visual field in tabes dorsalis in a less vague manner than the writers already cited. As regards colour he says "the vision for colours diminishes "progressively and in a certain method.... As a general "rule the perception of green disappears first, after "the field for this colour is markedly contracted. Red "disappears in the same manner, in such a way "that it is quite unusual to meet with an ataxic "patient who can distinguish green after the "perception for red has been abolished. Last of "all perception for yellow and blue fails. As "regards blue the field remains sufficiently long "uncontracted, so that, in a case where the field "for white is slightly contracted or even normal "we may have the blue and almost normal white

"perception

1) Uhthoff - Zur Pathologie der Sehnerven und der Netzhaut bei Allgemein-Krankheiten. Berlin. 1884.
v. p. 164 for comment on his views.

"perception for green and red has been for some
"time abolished." He quotes Uhthoff [1]) as an observer
with whose investigations he pronounces himself "en
"accord parfait." Uhthoff says he has observed
two classes of cases, first those in which there
is a more or less uniform diminution of perception
and acta of colour and correspondingly of peri-
pheral and central acuity. In this group he
considers the whole optic nerve, and therefore the
whole field is affected. Secondly (and more
rarely) in cases in which the optic nerve is par-
tially affected by pathological processes he says
the definite contractions of the visual field show
a sharp line of demarcation between healthy
and diseased sections of the nerve. That is to
say, the visual field is contracted by quadrants

- or

or concentrically, while the visual acuity and color perception may be found normal for central areas. The percentage of the first class here says is eighty, and only twenty in the latter groups.

The following cases have been grouped from the fact that the fields show a deficit limitations. Their characteristic is that generally they show contraction above and below, while the outer and inner parts in the horizontal line maintain the faculty of receiving visual impressions longest.

Case

Case 34, Andrew Mck (Plate XXXIV) shows Symptoms justifying the conclusion that tabes dorsalis is present. This patient, at present an assistant in a spirit shop, formerly in the army sought advice regarding a failure of sight especially after prolonged use of the eyes. Both pupils are contracted – they do not react to light, but yield under the influence of atropin. For two or three years he has suffered from darting pains between the shoulders, and in the knees and calves. He feels spasms in the limbs at night, and the kneejerk is (according to the note in the journal) much diminished. I failed to elicit it. No girdle sensation has been felt, but an uncomfortable sensation in the back is complained of. He is unmarried – has had syphilis. On Ophthalmoscopic Examination

1)

On the same plates the fields C & D are shown taken on June 18: and they confirm what is said on pp 154 & seq. regarding the progressive changes in the areas.

See diagram facing page 161.

— nation the discs appear small — vessels not marked diminished in size. The discs have a greyish pink appearance. The visual field in both eyes present contrasts as to the areas for colours. While the white area remains comparatively good that for green is markedly diminished. The blue & red fields are eccentric & contracted. The former instead of being the larger is in the right eye about equal to, & in the left eye smaller than the red. Further, the long diameter of the red, blue & green fields is situated in the horizontal meridian, showing a deficiency upward, outward & downward.)

This definite contraction of the field is more marked in the case of Wm McF (Case 35, Plate XXXV.). He complained of headaches, which he attributed to overwork at night, while following

following the occupation of an amanuensis.
For three months previous to consultation
he had been unable to read, from failure of
sight, and at the time when he was examined
his vision was so defective that he was only able to
read large sized type with strong convex glasses.

The knee jerk was absent, and he com-
plained of being unable to control the movements
of his legs while walking, whether by night or by
day. The nerves appeared, on first examin-
ation of a pink colour & cupped. The lamina
cribrosa in the left eye was distinctly seen. Six
weeks later the nerves were atrophied. The ves-
sels were markedly diminished in calibre.
No cupping was now seen.

It should be mentioned that this patient
consumed three ounces of tobacco weekly. No
Scotoma

Scotoma however was present and the colour vision was unimpaired. The tobacco also was light.

The fields are contracted, and show the area widest in the horizontal line. That for blue is, as in the preceding case, smaller than the red area, and the latter colour in the left eye has the largest area.

Contrast with these cases Case 36 (Robt S. Plate XXXVI) a stout and in every respect a healthy man. No signs of any disease could be detected in spite of very thorough examinations made while he was in hospital. His vision was so defective that he was only able to read the largest letters of Jaeger's Series. On examination with the Ophthalmoscope a high degree of hypermetropia (8.00 Dioptres) was found

found to exist, and the fundi presented appearances such as are observed in highly hypermetropic eyes. The nerves appeared small (due to an optical condition) and pink. The vessels were normal in calibre, but obscured in their course by exudation, and the retina presented the opaque appearance met with in ametropic eyes in which the optical defect has been uncorrected.

The case was one of neuro-retinitis and it was to be expected that appropriate glasses would improve the vision to a certain extent, normal vision not being immediately expected from the state of the fundus. Glasses however failed to alter matters. It was hoped that the field of vision would throw some light on the cause of the amblyopia. In the right eye the field was very much contracted (represented as

double

1) On the same plate, and on the same scale as that of Robert S.

double the scale of the preceding ones in this Section) the area for white, instead of being largest was smallest, and that for red largest. Blue was smaller than red, and with the exception of the latter all showed the long axis present in the horizontal direction. In the left eye the tendency of the fields to project relatively in the horizontal line was well marked. Red again appeared largest, and white small, about the same size as green. That this condition of the fields was not due to the state of the fundus may be assumed by comparison with the fields[1] of Kate McP. aet 25, a seamstress who suffered from compound hypermetropic astigmatism, and in whom the fundi presented the same appearances as those of the case at present under consideration.

Her

Her visual defect was easily corrected by means of glasses and the sight raised to the normal.

Her fields, though not diagrammatically correct, nor remarkably good for blue is nevertheless concentric, and the areas do not show any marked irregularity. The fact that with wearing her glasses for sight months her vision has ceased to give her any concern, and that all her functions are in keeping precludes any suspicion of organic defect. The fields of Robert S. from their shape and irregularity rouse the suspicion that the elements of a spinal (tabetic) or cerebral affection are present in his system, but have not, and may not assert themselves for years.

Case 37, Henry B (Plate XXXVII) shows a contraction resembling that of the left eye of the preceding

preceding case. The vision was defective (10 Jaeger) and patient complained that he could not see the whole of a word at once. Unfortunately the report is incomplete, but from it two facts are gathered, - that the optic nerve was pink and the vessels tortuous, and that the Knee-jerk was absent. The patient presented himself at the Infirmary on one occasion only, and I have received no reply to letters sent to the address he left. The fields are very irregular and overlap one another. That for blue is small, and the contour shows a tendency to be drawn to a point at the outer side.

On the same Plate (XXXVII. B) is shown a very contracted field in a case (No 38) under care of Dr Finlayson in the Western Infirmary, which may be summarized as follows:-

Two

"Two years ago had Sudden loss of consciousness with paralysis of both arms and legs, lasting for 3 weeks, accompanied by anaesthesia, loss of speech & complete paralysis of the 3rd nerve. Has now partial stiffness of both arms, & in addition suffers from dizziness, and pain at the back of the neck & between the shoulders. He also has frontal headaches & experiences pain when the left frontal region is percussed. The left leg is weak, and both feet trail slightly. Equilibrium is normal. Knee jerk slightly increased on the right side, normal or slightly diminished on the left. Has zoöma, perhaps of specific origin. No renal or cardiac lesion.

"Optical symptoms: Vision is about 12 Jaeger. but whether this is presbyopic or not cannot be said as the test was applied with out glasses.

Right

"Right pupil contracts more readily to light, but not more completely than left. Complains of occasional diplopia & inversion of images. Right nerve pale, choroidal pigment collected in patches round outer margin of nerve — Left nerve bluish to the outer side. Both nerves are contracted and their vessels diminished in size."

The visual area is very limited, and is confined to a small portion in the very centre with prolongations on either side in the horizontal line. It is so small that it is here represented as four times the scale of those projected on the red maps. The fields were taken in lamp-light under which blue appeared greyish, even to normal eye, and hence it was not available in the present case.

Case

Case 39 (David D) at on Plate XXXVIII shows the gradual reduction of the visual area coincident with the appearance of certain symptoms.

The patient's sole complaint was that he was short-sighted. He was able to read No 2 of Jaeger's series at a distance of 3 or 4 inches, and with concave glasses the vision was raised to the normal. The case was diagnosed as one of myopia with posterior staphyloma and a tonic was prescribed. I did not see the patient when he made his first visit to the Infirmary, but on his second visit, in July 1887 I noticed that his right leg dragged.

His mother stated that he had had two shocks of paralysis when teething, and that his general health had never been good. For the last two or three months he had suffered from frontal

frontal headaches, due probably to the uncor-
rected optical defect and the straining of the
eyes from the close application at his work
as a clerk.

An ophthalmoscopic examination showed
no changes in the discs indicative of disease.
There was no posterior staphyloma, but
(in the right eye) a congenital defect which
gave the appearance of the white crescent
characteristic of staphyloma. This appear-
ance is represented on Plate XXXVIII. The
disc is well defined and instead of being
uniformly circular seems prolonged upward
and to the right. This upper extension was
mistaken for a posterior staphyloma, exactly
the opposite side to that on which such
a thinning of the sclerotic as a rule
appears

appears. A second peculiarity is that the upper vein, instead of passing nearly straight upwards, and branching dichotomously turns sharply to the right and gives off branches, somewhat as the aorta does, before bifurcating. Further the upper and lower veins instead of rising together from the centre of the nerve have a clear space between them, and, while both pulsate, the rhythm is alternate, showing that the column of blood has further to travel in the one vein than in the other, the distance from their apparent places of origin at the disc to their common trunk being unequal.

The arteries also do not rise at the same spot.

The colour vision presented some peculiarities

peculiarities, which first began to be noticed 7 or 8 months previously. With both eyes he was unable to recognise small spots of red and green (vide Plate i). These he called white. Emerald green on a large area he called a kind of red. The green on Plate i (at the bottom) he called white. Red and green appeared to be variations of shade. Yellow was called red. These tests were applied with both eyes open. Tested with the right eye only, Purple appeared blue, and green to the left eye, but when placed beside blue these appeared red and blue to the right eye, and green and blue to the left. Blue and yellow appeared blue-white to the right eye, and blue and green to the left. Green with the right eye he called a kind of green

green, but with the left a kind of red. Red and green with binocular vision this colour appeared a kind of red. Red and green with the right eye be called red, but to the left it appeared green.

The field of vision at this time (July 1887) appeared contracted, the contraction in the left eye being concentric, in the right rather irregular. The green line showed the area for this colour, the disc however always being called white.

Six weeks later the fields began to assume a characteristic shape. In the right blue was smallest, and red largest. In the left eye red was still the largest, but white the smallest and the long axis of the area of the latter was marked in the horizontal.

Still

Still eight weeks later the field showed very marked limitation. Those in the small red (Plate XXXIX) Charts (C & D) show the actual size on the same scale as A & B, and as those on the preceding plate. Red was appeared in both eyes smallest, and White largest, and White in the right eye the long axis was beginning to show a tendency to lie in the horizontal direction, this, in the left eye was exhibited in an extreme degree. The fundi and vision for types still remained the same. Colours in the small areas were not told correctly, but in large size in the left eye no abnormality was seen. Green and yellow appeared white to the right eye.

The patient was complained of rapid movements of pronation and supination of both forearms

forearms, and of tingling along the back of the right forfinger. An area of insensibility was made out on the back and side of the first phalanx of this finger.

When standing he felt also the right knee giving way under him. (This was the limb affected with by infantile paralysis.)

When standing with the eyes shut he was unable to maintain his balance, and the knee reflexes were absent.

Case 40 (Plate XL) was under care of Dr. Gairdner in the Western Infirmary (Ward i. Journal 00. p 55). The following is Dr Gairdner's summary. "An extremely complicated diagnosis, involving probably cerebral & spinal, also perhaps peripheral nerves lesions. Paralytic attack at 12 years of age

"age, resulting in deformities of feet (vares). History of this very obscure. Relative weakness of left side ever since, but no distinct hemiplegic attack at this time. Three attacks of "inflammation of bowels" 19 years ago - pain in right iliac region - frequent headaches since the above, aggravated 4 years ago. Distinct attack of hemiplegia (left.) 4 months before admission. No loss of consciousness. Partial recovery after 3rd day from seizure. Pain in movements on paralyzed side. No anaesthesia - no rigidity - Knee jerk rather diminished - no ankle clonus - special paralysis with muscular atrophy of left thumb + fingers."

The ophthalmoscopic examination by Dr. Reid is asked as follows: "have has been in a state of passive congestion giving the disc a slight pinkish

"pinkish injection and veiling its outline. The interstitial tissue along with the capillaries seems to be the seat of disturbance rather than the parenchymatous tissue. On ophthalmoscopic examination colour sense is apparently intact. "Is able to read out print comes in eyes after use."

With regard to the colours it is to be noted that patient was a weaver, and required to be able to detect minute variations of shades.

The field shows the long diameter horizontal. The blue area is small and near the edge of green. The peculiarity however is present, that it draws to a point to the inner side and not to the outer as in those mentioned above. In the limitation of the field to the temporal side, showing implication of the nasal side of the retina in any way connected.

1) This wd imply some lesion on the left side.
Time did not permit of both eyes being examined.

connected with the localization of the disease on the ~~left~~ right side of the brain? If the field were in a certain degree comparable with hemianopia the nasal side (i.e. temporal region of the retina) would be ~~all~~ lost,

In case 41 Mrs C. (Plate XLI) there is a distinct history of recurrent attacks of cerebral meningitis. The note in the Journal (by Hofmann) is as follows:
"Dimness of vision of two months duration
Vision of R = 8 Jaeger. and of L = 6 J.
Dimness followed attack of meningitis which confined her to bed for some time.
Ophthalmoscopic Examination: R. nerve oval obliquely, slightly excavated at outer segment.
L. nerve oval vertically. Neuritis in both."
On the first visit the field was taken, and showed

) Compare the outline of the field from Stirk with that of flowers for red green on p. 94. left eye.

showed (Plate XLI. A & B) contraction for white and great contraction for blue, red and green.[1] The contraction was greatest above & below, leaving the major diameter of the field in the horizontal line. That for blue was, in the right eye smallest. In the left eye it was comparatively small. The red and green fields in both eyes overlapped.

A month later (November 1887) the vision was worse (R = 14 J. L. 8 J.) and the laminae cribrosae began to be apparent.

In December 1887 cupping of the discs with pushing of the vessels to the nasal side of the nerves was noticed, the discs appearing of a pink colour. She continued to attend the dispensary till march of this year, when word was sent by her family doctor that she

1) The pupils however were active, and normal.

she was seriously ill. Dr. Ramsay went to see her and found her sight quite gone. The optic nerves however presented no appearance other than noted above.

About the middle of april she was able to come to the hospital, when I made an ophthalmoscopic examination. The right nerve was greyish, but normal in size. The vessels were normal but obscured by exudation towards the nasal side. In the left eye the nerve was paler than on last examination — the lamina cribrosa was apparent, but the cup previously noted was filling up. There was also pulsation in the ascending veins. The vision had returned, and was for the right eye 18 Jaeger, and 16 J. for the left. She was not strong enough to undergo a lengthy examination

examination with the perimeter, but she was able to give some details of former illnesses. These began seven years ago when, during a period of "nervous prostration" caused by grief at the death of her husband, her sight suddenly left her and did not return till three or four weeks later. The recovery was complete, and for the next four years she remained free from any ailment. She occasionally however experienced a feeling of "rushing of blood to the head" which at the end of that period caused her such distress that she had to take to her bed. This feeling was characterized as a tightness of the head, and a sensation as though her head would burst.

In May and June 1887 a second attack

confined

confined her to her bed, and, in March of this year, a third attack, evidently of a more severe nature laid her up. Although during the previous attacks she had never lost consciousness, during this last attack delirium was present for twenty four hours. The sight went away suddenly during the night, and came back almost as suddenly (certainly within twenty four hours) a fortnight later. She had severe pain on passing water, and constipation, also pain in the left arm (attributed to rheumatism) but no paralysis. The eyelids, during this illness twitched very much. She has always had (during the time she has been under observation at the Infirmary) some prominence of the upper lids, and this she says has been noticed in the last year or two by her friends.

The pupils

The pupils react to light. *

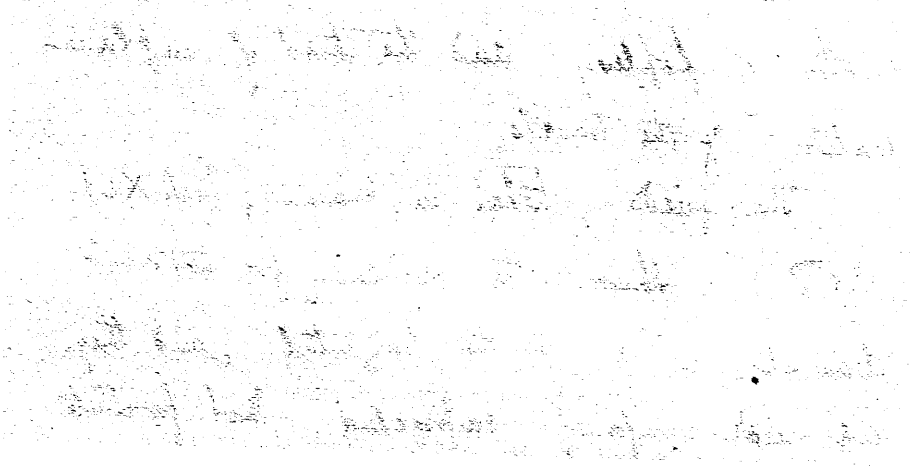
The vision at the present time (June) has improved to 6/J, and is therefore as good as, if not better than it has ever been during the period of her attendance at the Infirmary.

An important point, demonstrated by Dr. Ramsay, is that pain is caused when the eyeballs are pressed back in to the orbit.

In the history of her family it should be said that three brothers are dead, one of phthisis, another of apoplexy, and the third of inflammation of the bowels.

The fields, taken in May. (Plate XLI. C D.) show the tendency for their major diameters to lie in the horizontal, and they are most uniformly contracted. That for white has become relatively more contracted than those

On June 18. 1888 The visual fields are found to retain the lozenge shape. Vision is improving. (R = 12 J. L = 4 J.) The nerves are passing into an atrophic state _ margins ill defined _ the discs having an opaque appearance, greyish tinge in colour.



those of the other colours, and blue is increased in size in both eyes.[1]

Case 42 Patrick J. (Plate XLII.) was sent from the Western Infirmary to the Eye Infirmary for a report on the ocular condition. The report in the Western Infirmary Journal states that 6 months prior to admission the patient suffered from running from the left nostril with pain concentrated over the left frontal eminence. The pain was stinging and darting and never changed its position.

Four months later he became suddenly unconscious, owing, he says, to gradual increase of the pain. The left eye now became affected with copious lacrimation. Pain abated for about a fortnight, then returned accompanied by giddiness. The note in the Eye Infirmary

The infirmary journal on November 9. 87 was as follows: Vision of R. = 2/Jaeger. of L = largest letters. Paralysis of third nerve on left side, Pupil dilated. Eyeball everted, but retains a certain amount of mobility. High degree of hypermetropia. The ophthalmoscopic examination showed the right nerve reddish-grey in colour, surrounded by a ring of atrophied choroid. The veins were slightly smaller than normal; the arteries were small, with exudation covering their point of exit from the optic nerve. The left nerve was paler in colour - the vessels small. Both nerves appeared contracted. The field was taken on November 28th the upper lid of the left eye being raised while the measurement of this eye was being made. The colour asked, for

the

[1] Ward i. G.W.I. Journal NN. p 180.

the colour, but not shape of the disc) was fair. The shape of the disc however was not recognized till within a small central portion of the field. The dotted line in the left Eye shows the area for white (colour but not shape); the continuous blackline marks the white area for colour and shape.

In both fields the loss of the upper & outer & lower-outer segments is well marked, their boundaries being as sharply defined as if a separation were present.

Case 43. (Plate XLIII) was also seen from the western Infirmary, under care of Dr. Samson Gemmell, acting in absence of Dr Gairdner.) Patient complained of pain at the back of the head. Extending along the left side to the margin of the eyebrow. This he had suffered from for four

years

years. Occasionally it extended to the right side.

There was pain on, and after percussing the heart, and while the pain was present he had some difficulty in pronouncing words and in reading, although he understood what he read. No history of fits.

Ophthalmoscopic Examination (by Dr Reid):
"Both optic nerves are of deeper tint than normal, surrounded by thin whitish rings indicative of staphyloma posticum. In the left eye the vessels are accompanied by reddish streaks of exudation. The white ring above referred to is supposed to be associated with choroiditis.

Vision is normal when aided by weak convex glasses. The defect of vision might be accounted for by failure of accommodation."

The case appeared to be one of neuralgia of the

of the scalp, and the patient left hospital unrelieved. Prior to this, however, Dr. Reid asked me to take the fields in the hope that they might throw some light on the diagnosis. The tendency of the major diameter of the areas in both eyes to lie in the horizontal direction is well-marked.

In both eyes the fields for green or white are smaller than those for red or blue.

I accidentally heard of the case some months later while talking of brain tumours and their symptoms with one of the surgeons of the Eye Infirmary. He told me he had been asked to see a patient (whom I knew, from certain circumstances to be this one) who was supposed by his usual medical attendant to be suffering from cerebral tumour, with a view to admitting

admitting him to his ward and operating on him.
The surgeon told me he had prescribed anti-syphilitic treatment with the result that the cephalic pains had entirely disappeared, and the patient had been able to go back to work.

Case 44 Agnes McL (Plate XLIV)
Shows the field in a case in which the nerves presented the appearance met with in the later stage of syphilitis. They appeared transparent, greyish, with obscured margins. The vessels were accompanied by broad white lines. The history was obscure. Beyond frontal headaches nothing was complained of. The left eye became affected ten months before she was first seen, and the vision was greatly reduced

reduced. A few weeks later the sight of the right eye began to fail, but recovered in a short time so that at the time of admission to the eye infirmary she could read no 4 of Jaeger's Types. With the left eye she could only read no 18, and the field could not be taken. The discs could only be vaguely distinguished when held to the lower and outer part of the field.

In the right eye the field shows the contraction from above and below, with the long diameter horizontal. The area for blue was smallest, and those of red and green encroached upon one another.

Case 45 Robt H (Plate XLV) shows a contraction of the field similar to those in this

Section

Section. The vision was 10 Jaeger, and the sight had been failing for some months, accompanied by frontal headaches. The patient smoked 2 ounces of tobacco weekly, but there was no scotoma detected, nor did the state of the optic nerves and vessels warrant the diagnosis of tobacco amblyopia, although the history of the case resembled that of cases in a former section.

The nerves were pale, chiefly in their outer aspect - the retinal vessels diminished in calibre, and sharp in outline - changes in choroidal pigment without obvious lesion. The case was diagnosed as "Choroiditis."

Unfortunately no data are noted as to the physical condition. The age of the patient - 24 - is against the presence of tabes

dorsalis

dorsalis, but the negative character of the report does not exclude this disease.

Compare with it Case 46 (Ronald McD. (Plate XLVI). Here the symptoms were identical, with Cowper glasses he was able to read No 4 Jaeger with the right eye, and No 16 with the left. The reflexes were normal, and there were no signs of tabes dorsalis. He drank little, but smoked two ounces of tobacco weekly.

The ophthalmoscopic examination showed both nerves bluish in the centre and to the outer side, the rest of their surface being pink. White he called greyish. The fields for the right eye showed contraction for the nasal and temporal sides. Green was greatly contracted; red was largest, blue and white of intermediate

Size

Size In october of 1887 the long diameter
field for the
of the right eye instead of being vertical was
now horizontal. Green still remained smallest,
White was now largest, and then red.
In the left eye the loss of the upper-outer
& lower-outer segments was well marked.
The field was greatly contracted, and the
others were about equal in size.
At present (June 1888) no signs of tabes
dorsalis are present. The nerves are atrophied.

Case 47. John P. (Plate XLVII). Here the
fields are of fair size. The right one does
not show any great departure from the normal.
The left however shows loss of the lower and
outer segment. The blue area in both
eyes was about the same size as that for
white

white. The ophthalmoscopic examination showed the nerves blue in colour and contracted. The vessels were enlarged and numerous. No cup was present. The reflexes were diminished.

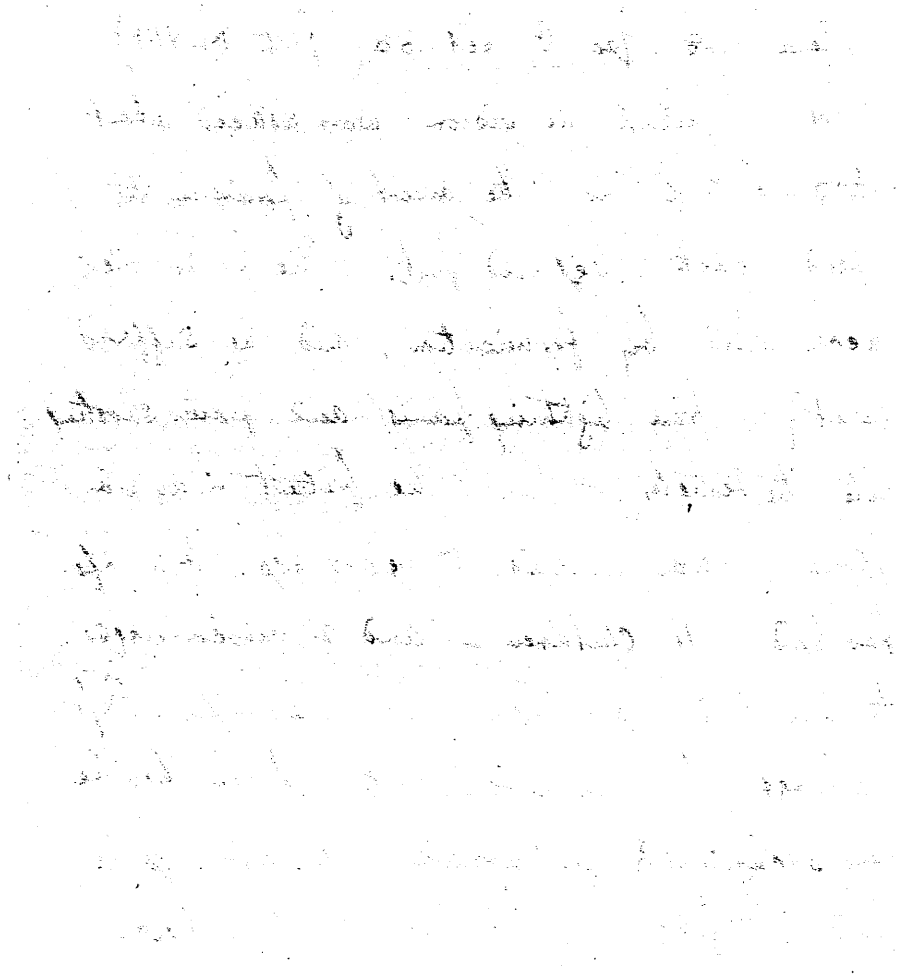
By refraction there was hypermetropia of 2 Dioptres. The vision of the right eye was 12 J, and 16 J in the left, and it was raised by the aid of +9. D. glasses nearly to normal. The diminution of the visual acuity was not due to failure of accommodation, for had this been the case he should have been able to read small type with glasses half the strength of those mentioned, viz. +4.00 or +5.00 D.

The following three cases were ones in which the symptoms of tabes dorsalis were pronounced

pronounced.

Case 48. Geo C. aet 38 (Plate XLVIII).
The patient in vision was noticed about the same time as the onset of pains in the head, back, legs and feet. The pains were accompanied by formication, and he suffered greatly from lightning pains and pains shooting into the testicles. The patient is an iron-planer, was married 17 years ago. His wife has had 11 children – and 2 miscarriages. He has had gonorrhoea, but no syphilis. Before marriage he was intemperate. Since then he has occasionally got drunk. A year ago he had a "fit." At present the reflexes are absent. He sways + walks unsteadily. The vision is reduced to 1/6. with the right eye, and 1/2 with the left. On admission the

word



1) Note made in may. 1887. The vision at this time was 1/7 larger for both eyes.

word "neuritis" described the condition of the nerves — presumably referring to a pink condition. This passed off, and when last examined the nerves were pale, and contracted, bluish in their center — arteries small. The visual field (Plate XLVIII. A) shows the areas very much contracted, chiefly laterally. That for red is largest, & that for blue smallest. Perception for green was not accurate. To the outer side it appeared bluish.

Case 49 (Plate XLIX. A & B.) Alex. McL. Shows also signs of tabes dorsalis. The dimness of vision came on about the same time as certain "fits", and he acknowledges that he has been intemperate. The reflexes are diminished, and prickly pains in the limbs, as well as

Sudden

Sudden pricking as complained of. Equilibrium is slightly affected. The pupils hardly respond to light. Both nerves are atrophied.

A year later the pupils are noted as active. The vision is improving. Nerves are bluish - condensed to inner side, cupped to outer side - lamina cribrosa distinctly seen, vessels normal.

The field for the right eye a year ago was nearly normal in shape and disposition of colour areas. The upper and outer segment was slightly contracted. At present (April) this segment is considerably diminished, and similarly, but to a less extent the lower outer part. The colours are seen for about the same extent in every case.

Case

Case 50 (Plate XLIX, C & D) is at present in the western Infirmary, under D. Mc Call Anderson's care. In the summary it is stated that all the symptoms of tabes dorsalis are present, except the Argyll-Robertson phenomenon.

The vision is nearly normal. Both nerves are bluish pink, surrounded by white zones. The vessels are not marked of reduced in size, but their exit from the nerves is veiled with exudation. The nerves are somewhat contracted.

The visual fields show well marked sectors of deficiency chiefly above and inwards and outwards, and they cross and re-cross one another. Both show a tendency (especially the left) for the long diameter to persist downwards and outwards.

Case

Case 57 Donald S. aet 24 (Plate L).

When this patient was seen in May 1887 there was a history of dimness of vision (R = 20/. L. 12/) of two or three weeks' duration, accompanied by pain on crown, occiput of head & temples. The patient is a strumous subject, and of his brothers & sisters 4 out of 10 are dead. In addition to the cephalic pains he felt his hands and feet "asleep", this sensation coming on and passing off suddenly. On ophthalmoscopic examination a band of exudation was seen stretching across the lower part of both nerves, occupying in the case of the right nearly half of its diameter. The rest of the nerve was pink.

The field of the right eye taken in bed showed for white a fair area. There was however a small

Small central scotoma.

In September he was able to read the smallest print with the right eye, and the field showed the area for white contracted above and below. Those for red and green limited on all sides, chiefly laterally.

In February 1888 the vision of the right eye had again became diminished = 16 J. That of the left was also worse. Portions of the largest letters being now seen when looked at obliquely towards the lower and outer part of the field. The nerves appeared pink and prominent, and raised up. The band of hyperæmia was still present on the right nerve. The field was very much contracted. the long axis being markedly vertical, and a month later this condition was still present, although

the

the area was relatively much greater.

Hermansfeld

Hemianopia.

Two cases are here given, one in which, after death a tumour was found accounting for the loss of the half of the visual field - in the other the hemianopic condition passed off.

Case 52 Archd T. aet 25 (Plate 41.)

The patient was admitted to the Eye Infirmary on March 29. 1887. complaining of dimness of vision of 4 months duration. The symptoms appeared to date from the new year of 1887 at which time he began to suffer from pains in the back and left arm. Pains in the head next made their appearance, localized to the left side of the head, coming in paroxysms and shooting down along the left temple to the

inner

inner canthus of the left eye, and backwards to the occiput. The pain lasted for several hours and had persisted till admission to the Eye Infirmary. The visual defect was gradual in its onset, and the failure was chiefly marked in the left eye. The hearing of the left ear was also affected.

The note in the Eye Infirmary Journal on admission was as follows: "Vision of R = 1/3. of L = 20/. Dimness in R. is occasional & transitory, especially on exertion or rising. It is permanent in L. Eye affection connected by patient with temporary deafness from cold. Pupils rather dilated and sluggish. On Ophthalmoscopic examination of both regions of disc are occupied by streaky & mottled exudation. Vessels emerge at some distance from the discs.

Their

"Their margins cannot be defined. Refraction of discs = +6·00 D."

The fields, measured April 26. showed hemianopia - loss of the temporal side of the right field and nasal side of the left, with a slight projection downwards in both from the seeing side to the defective side. The field indicated some interruption with the conducting apparatus of the nasal side of the right retina and the temporal side of the left, thereby showing that pressure existed on the left optic tract. The water colour drawing on plate LI shows the state of the left fundus. To summarize briefly the case it may be said that Sickness set in on April 26th the headache remaining persistent. On May 2 he began to complain of

of stiffness of the back of neck, and the temperature rose to 101.° On the same day his mind was wandering, and the speech incoherent, and on the following day the pain began to extend down the spine. Till May 6, when he was transferred to ward 10 of the Western Infirmary to be under the care of Dr. Tennent, the symptoms increased in severity. He was very restless and at times could hardly be persuaded to stay in bed. He resented being touched, and frequently cried out with the pain in the head. No paresis nor paralysis was observed, and on this point it should be said that on admission ~~from~~ from the patients' statement no such sign had ever been present. The reflexes were normal, and no areas of hyperaesthesia or anaesthesia were made out. Pain, however

however was elicited, on admission, on tapping over the anterior parietal and temporal regions on the left side.

On being transferred to the western Infirmary it was noted that the pupils were widely dilated, and did not respond to light. The tâche cérébrale was present, and the patient could be roused and spoke intelligently, but three days after delirium supervened, the kneejerk on both sides was absent, and hair cheiff frontal appeared to be present.

On May 12. Extreme opisthotonos came on, the head was greatly retracted. Death occurred on May 16. The post-mortem examination revealed the presence of tubercular meningitis, and a tumour present in the left temporo-sphenoidal lobe. "It is found to be

"to be a bulky growth of very irregular shape.
"The total extension deeply is about one and three-
"quarter inches, & and from before backward one
"inch. Superficially it consists of several con-
"joined lobes, but deeply it forms a bulbous mass
"about one inch in diameter, which projects into
"the lateral ventricle behind the nucleus lenticularis.
" The bulk of the tumour is caseous, but there
" are the usual transparent parts which present
" under the microscope the tubercular structure
" with giant cells prominently present."

The

Western Infirmary. Ward 1. Journal P.P. page 204

The other case, Peter Mck. aet 31 (Plate III) was summarized by Dr Gairdner as follows:

"Symptoms of cerebral (probably coarse) disease of very marked character, but not very distinct as to localization, except that the lesion is most probably on the right side. The first failure in point of time (observed) in fingers of working hand (needle) 17 months before admission.

"Pain in head (seven above R. eyebrow) 2 months later. This symptom migratescent, & some weeks later accompanied by vomiting of the most significantly cerebral type. Somnolence also observed about this time, and afterwards, but never to extent of coma. Progressive muscular weakness and instability (like a drunken man but without vertigo) & loss of distinct vision, especially in the left eye were symptoms in sequence to above

"bove. Dorsal decubitus from Oct. to Dec./87 appeared to give rise to improvement. Aphasic manifestations (?) Sensation different at both sides. Knee jerk increased. Nystagmus."

On the 15th of April I examined the eyes ophthalmoscopically. The right nerve was grey and contracted. Surrounded by a pale ring of atrophied choroid. The vessels seemed to emerge at some little distance from the center of the disc, and were veiled at this point by exudation. The disc was striated radially. The vessels, especially the arteries were small. The veins had no marked reflex. In the left eye the same condition was present. The vision was such that he was able to see the largest type and to tell the time by the watch.

On measuring the field of vision hemian-

opia was found to exist, the temporal side of the right retina and the nasal side of the left retina being defective, thus pointing to a lesion of the right optic tract. The line of demarcation however was very irregular for colours, and for green there was slight haziness noticed by the patient as the travelling disc passed beyond the dividing line, before it became invisible. The dividing line was not exactly vertical, but maintained this direction fairly exactly from above till the fixation point was reached. It then took a course towards the left hand. The areas for the seeing half of the right eye showed the upper and lower outer segments deficient.

This condition was remarkable because the discs showed no evidence of cerebral disturbance.

On

On May 24 the fields showed that the hemianopia was no longer present. The fields were very much contracted and irregular, and the vision with the aid of convex glasses was brought up to normal.

General Conclusions.

The inferences to be drawn from the foregoing perimetric examinations may be here briefly stated. The definite nature of the visual field in Separation of the Retina, embolism of the central artery of the Retina, Retinitis Pigmentosa and glaucoma, is so universally accepted that these diseases need not be referred to at the present time.

A considerable difference of opinion however exists as to the contraction of the visual field in diseases of the nervous system. The nature of the contraction is described in such vague terms that no alteration has been asserted to be pathognomonic.

I have

I have however grouped cases for the purpose of trying to show that a definite contraction of the field does exist. Throughout I have been fully alive to the fact that I have not had the opportunity of following up the cases, and have been able, in individual instances, to study the particular nervous lesion at one stage only.

This might mean an interval of years before the appearance of other signs. The cases, however, which have just been given show the peculiarity of the field so well marked, that, even with my imperfect reports and with solitary examinations which have been made I venture to record them at present in the hope that at some future time I may have an opportunity

of

[1] This is generally accepted.

of establishing what I regard to be a most important, perhaps the earliest, sign of cerebral or spinal disease.

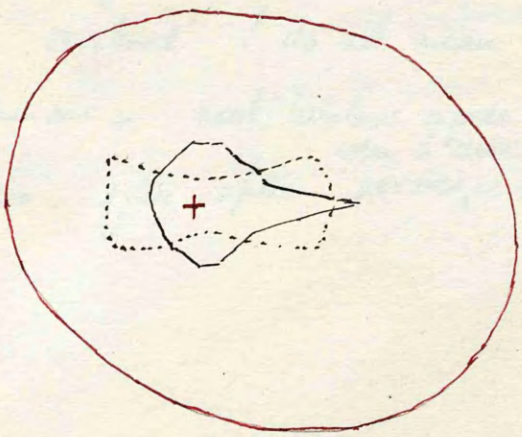
It has already been hinted that an ophthalmoscopic examination generally is considered sufficient in diseases of the nervous system — other examinations not being regarded as necessary. But if the condition of the optic nerve throws light upon the subject it is probable that its functions will also furnish evidence, and if its appearance is negative it does not follow that the visual phenomena are to be disregarded, for it may happen, and in the Section on Scotoma I shall show that it does happen, that great visual defects may exist in spite of a normal condition of the optic nerve and fundus as seen

seen by means of the ophthalmoscope. Certain of the phenomena (the appearance of the optic nerve as described by Charcot, and the pupillary sign of Argyll Robertson) are looked upon as diagnostic. There is no reason why the visual shape of the field should not come to be regarded in the same light. It has this to be said against it that its state is not an invariable one, but it would appear to vary according to the stage of the disease and the presence of other symptoms. It is this small detail, apparently, that has caused the opinions of observers to be so vague as to its shape in tabes dorsalis. No account seems to have been taken of the particular stage of the disease, nor of the extent of the implication of the optic nerves.

So that

so that a writer who says that the contraction of the visual area is concentric is not to be judged in error although some one else may say that the contraction is by sectors. Both are right, but are describing different stages of the disease.

From a study of plates XXXIV to the end it will be seen that, as a general rule the field is contracted from above downwards, and that the upper-outer and lower-outer sectors are lost. This may be represented diagrammatically thus: (for the right eye. the red line showing the normal shape and the + the fixation point).



This, it will be seen is not unlike the field shown on pages 94 - 95, as described by Gowers & Griffiths. These writers do not, however attach any importance to the shape of the field given. I take such a contraction to be an early, perhaps the earliest sign of disease of a cerebral or spinal kind.

It may be urged that in cases 36, p 104; 45, page 132; 46, p 134; 47, p 135: no symptoms of disease exist. It is in these very cases in which no symptoms of any value indicating cerebral or spinal implication as present that the test is of most importance.

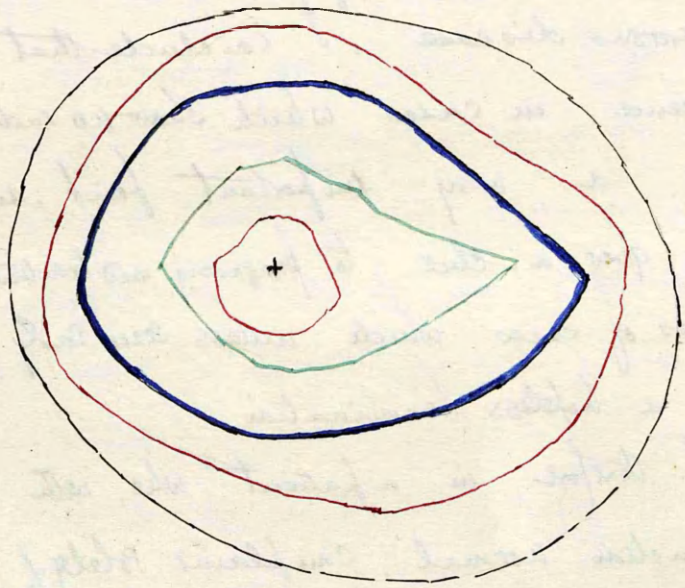
In such cases of spinal or cerebral origin - and by cerebral I do not mean of necessity a tumour - most writers agree that this sclerosis of the optic nerves when it does occur is an early sign,

See page 93

Sign, as I have already quoted[1]. They say it may precede all other signs for years, it may exist alone, and the other signs may never appear. From the fact that this definite contraction is found in cases showing signs of nervous disease, I conclude that its presence in cases which show no such signs is a very important point, and that it gives a clue to prognosis and treatment in a class of cases which unless seen early go on to a hopeless termination.

I therefore in a patient who, with every function normal, complains solely of a dimness of vision — unaccounted for by refraction anomalies, and unimproved by appropriate spectacles, a dimness unexplained by the state of the fundus — the visual

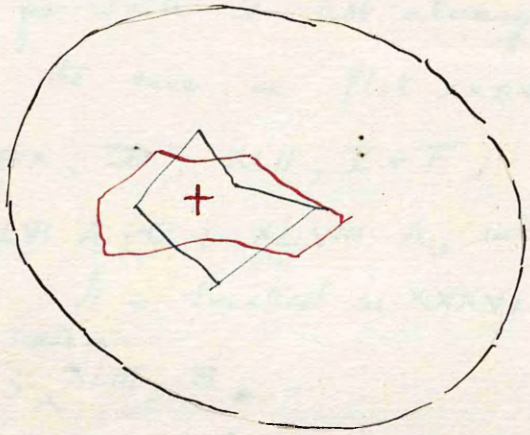
field



shows the defect which I have described
there is dependent on this solitary symptom, a
strong presumption that a nervous lesion
is present, and will ultimately develop
either in the legs or in regions of the cord
giving rise to a characteristic chain of symptoms.

What then is the condition of the field
at different stages? Taking the cases showing
signs of tabes dorsalis the first alteration
would appear to be a slight concentric nar-
rowing (Plate XLIX. A. case 49. p. 138) outlined
line on diagram on opposite page —
Then slight deficiency of the upper-outer
lower-outer sectors (Plate XLIX. B) (blue line)
Then further loss of these sectors (Plate XXXV.
B) — the field for left eye reversed so as to
correspond with right (green line) — Then loss
of angular projection (Plate XLVIII. A.) inner
red line.

Cases cerebral in origin show a contraction even more definite in character:



The red line indicates the earlier form of the field in Case 41. page 120 (Plate XLI) and the blue line the general shape in case 42, p. 136. (Plate XLII). and the last examination of case 41. shows the shape given by the blue line in the above diagram very markedly.

In addition to the shape of the visual

of the field the disposition of the colour-areas has been found in these cases to have some peculiar abnormalities.

That for white is not always largest. This is the case in plate XXXVI. A & B; XXXIX, D; XLII, E & F; XLIII; XLV; XLVI A & C; XLVIII A; and LII, B & C. It is smallest in XXXVI, A: and in XXIX, B; XLIII, B.

Blue similarly is smaller than red in nearly every instance. Except in XLII, E. Green is very much contracted and out of proportion to the other areas in only one instance, viz: plate XXXIV, A and B.

Perception for Blue and white, therefore, would appear to fail sooner than that for the other colours in matter of extent of the field, but to

See page 98 - 99.

remain longest, although greatly contracted.
"This varies greatly with the opinions of Dr Wecker & Uhthoff given above.[1])
In one case was the perception for green defective. (Case 39, page 111) - and in this case it is to be noted that the visual field became contracted more and more as symptoms of a nervous lesion became developed.
Although in this case the symptoms, taken, were those of tabes dorsalis it is difficult to ascribe all of them to this affection, more especially as there was present, at an early period of the patients' life a lesion of the anterior region of the cord.

at the

At the moment of sending in this Thesis I have been able to make further measurements of two cases. In case 34 (page 101) which is undoubtedly a spinal case the contraction of the field has advanced so as to assume the characteristic shape.

In case 41 (page 120) a case presenting the fields are more contracted, and assume the form distinguishing the others in the section, in spite of a decided improvement in vision.

Full bibliographies are to be found in de Wecker + Landolt's Traité Complet. That last quite supplements the list of authors given in that work, and was for the most part compiled before the publication of the Fourth Volume (Early in 1888), the bibliography of which, on diseases of the Optic nerve, contains upwards of a thousand references.

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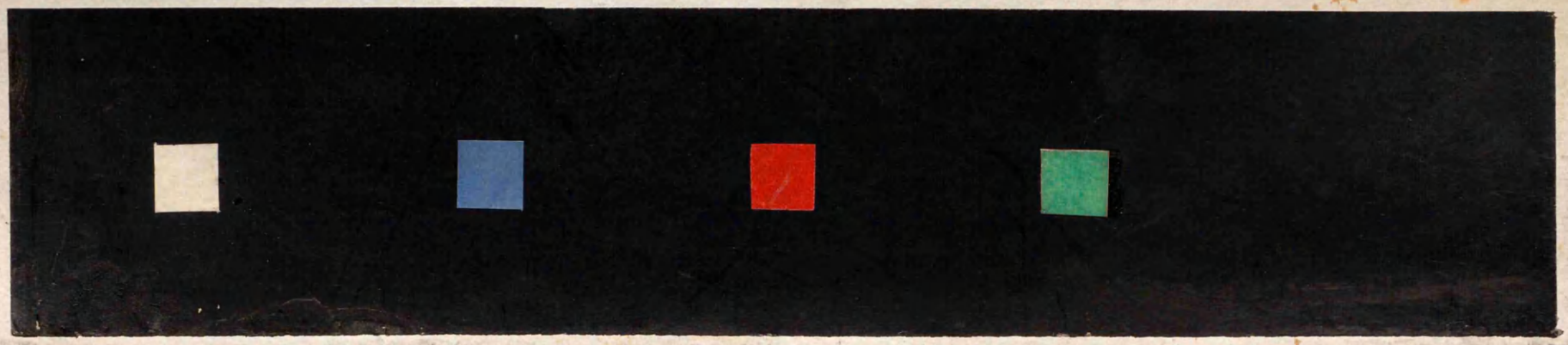
ATLAS OF CHARTS illustrating the FIELD of VISION. 52 Plates:

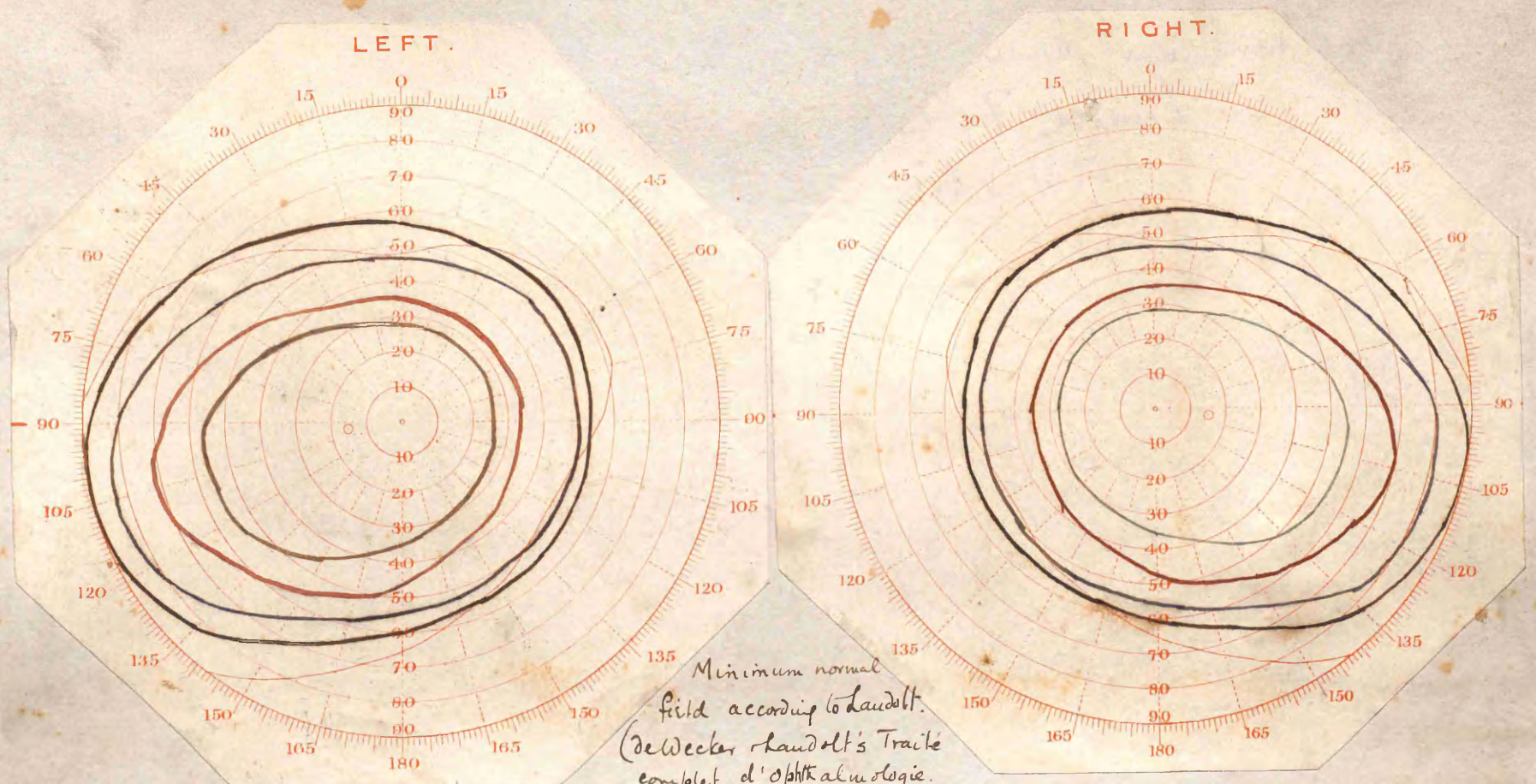
16 1888

accompanying a Thesis on the Subject, for the Degree of M.D. in the University of Glasgow.

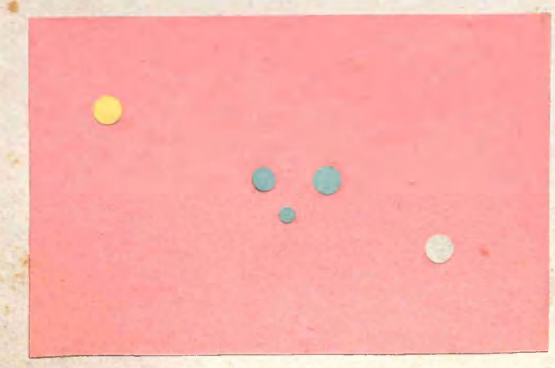
William Corbett



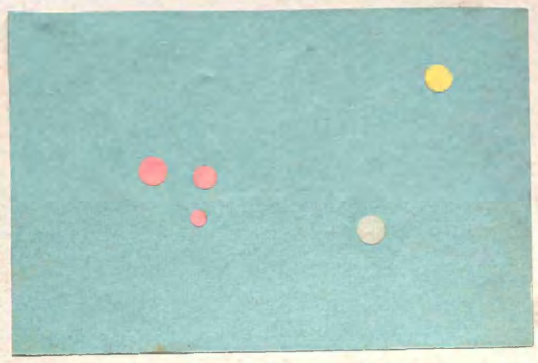
Size and colour of discs used in measuring the Fields of Vision of the accompanying cases.

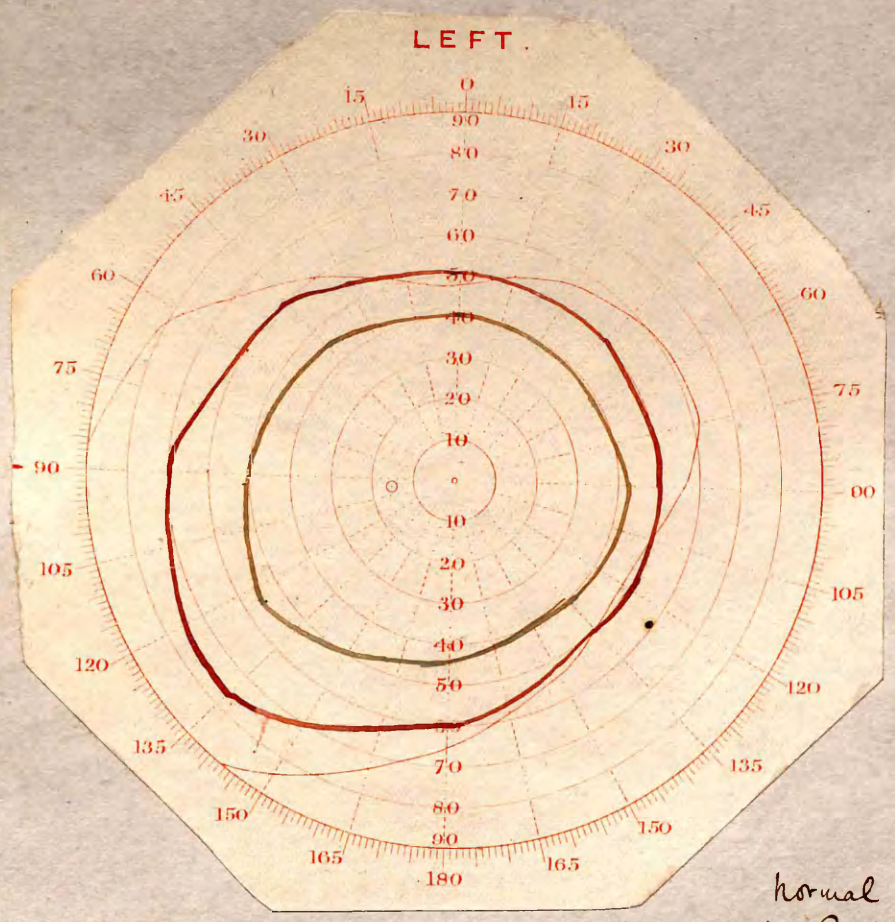


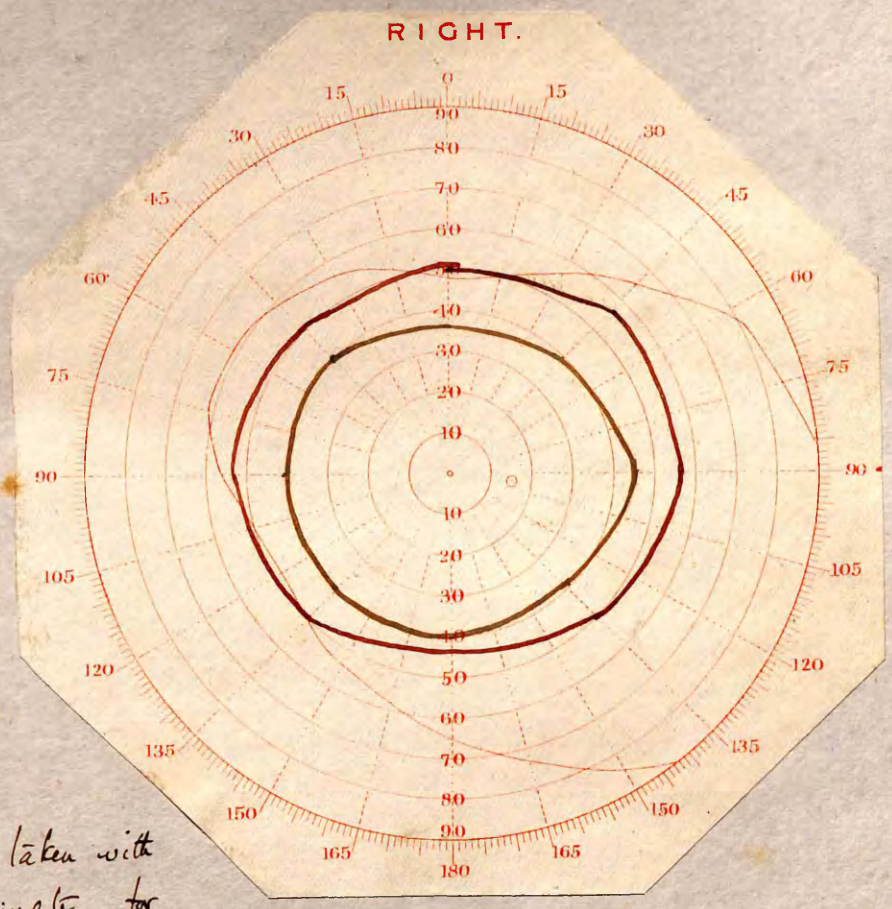
Minimum normal field according to Landolt. (de Wecker Landolt's Traité complet d'Ophthalmologie. vol i. fig 139.)



Cards used to test cases in which central scotoma is suspected. The spots are 2, 3 and 4 mm. in diameter.







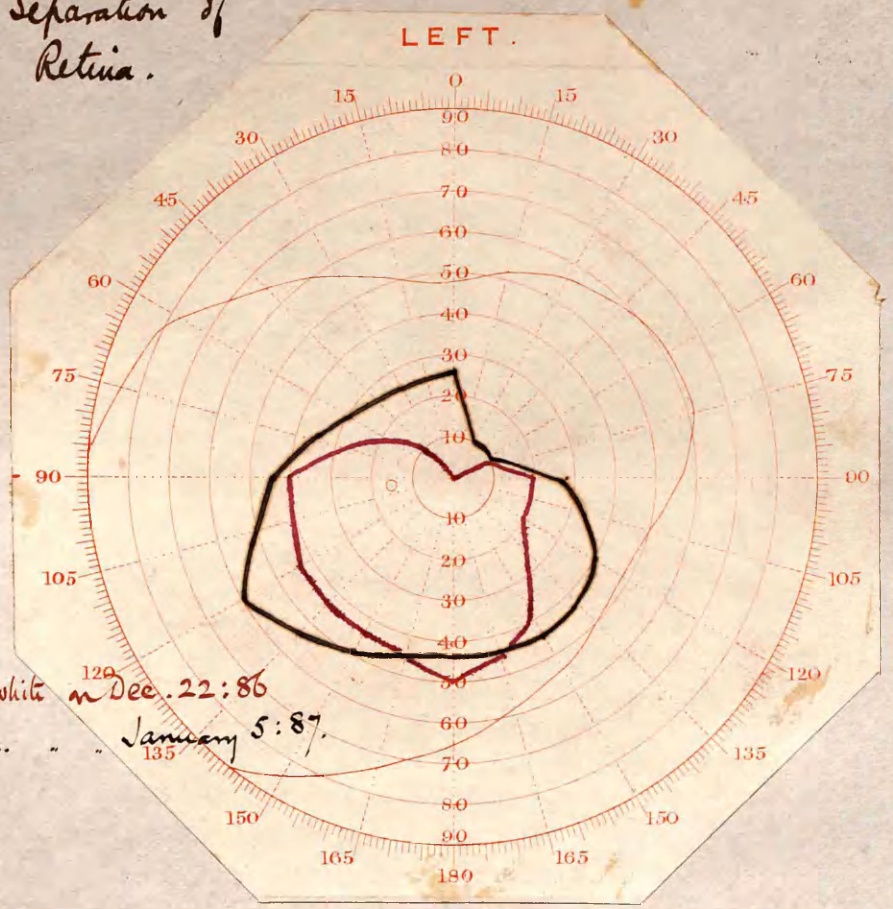
normal fired taken with
& Reid's perimeter, for
red and green.

Plate iii

Patrick S. aet 30. No. 49698. Case 1. p. 27.

Separation of Retina.

A



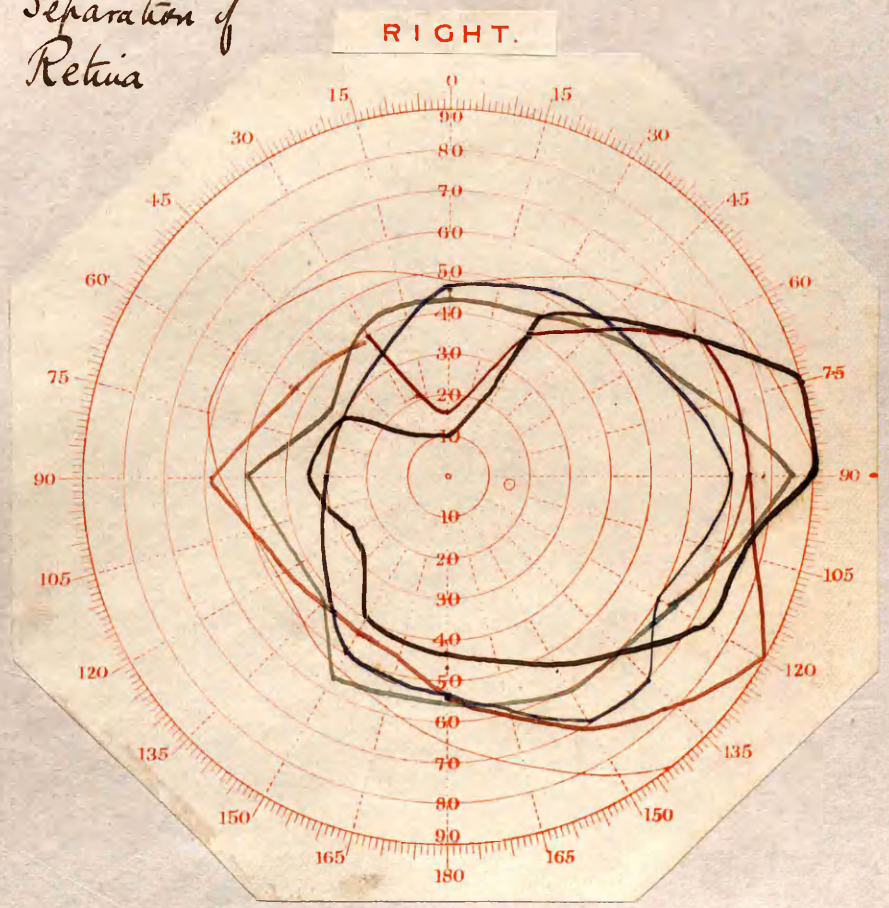
— = field for white on Dec. 22: 86

— = " " " " January 5: 87.

William C. aet 27. No. 48587. Case 2. p. 28

Separation of Retina

B



— field for white on Oct 19: 1886.

— " " " " Nov. 2: 1886.

— " " " " Nov. 9: 1886.

— " " " " Nov. 16. 1886.

Separation of Retina

Andrew F. aet 16. 49588

Case 3. p. 28

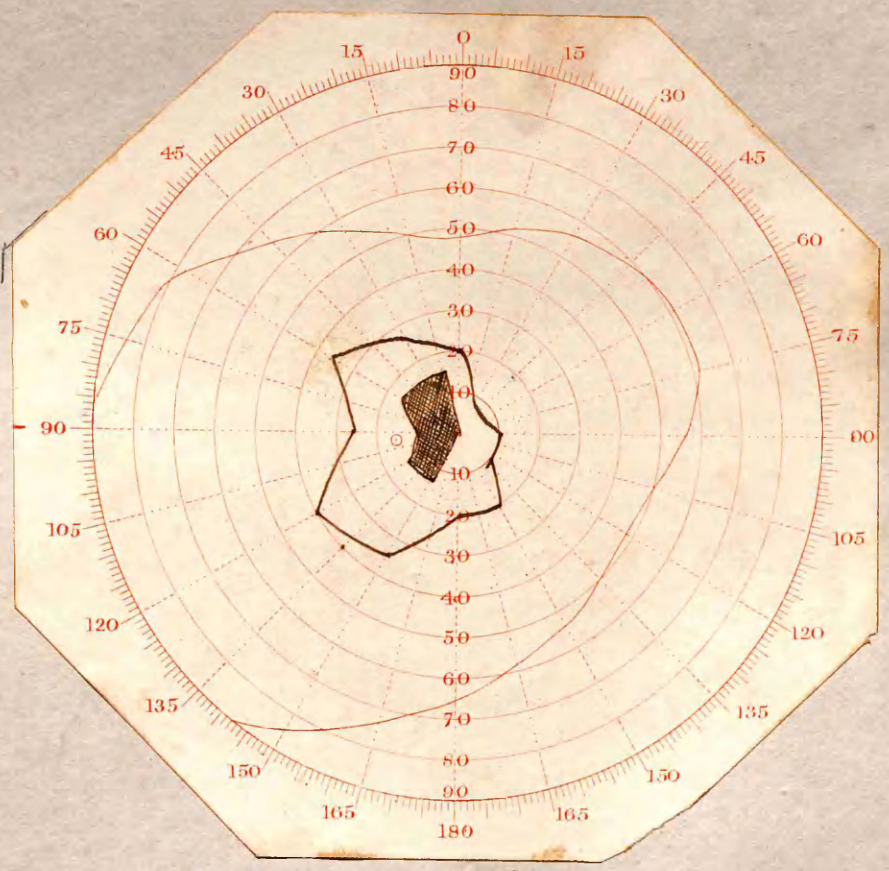
Plate iv

LEFT.

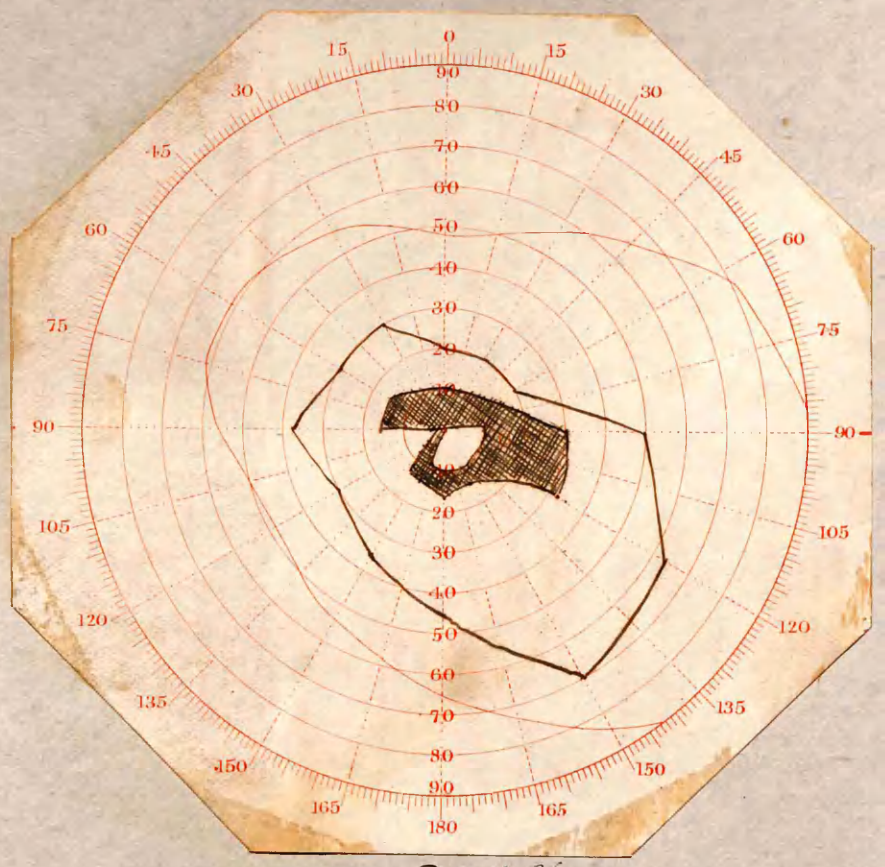
RIGHT.

B

A

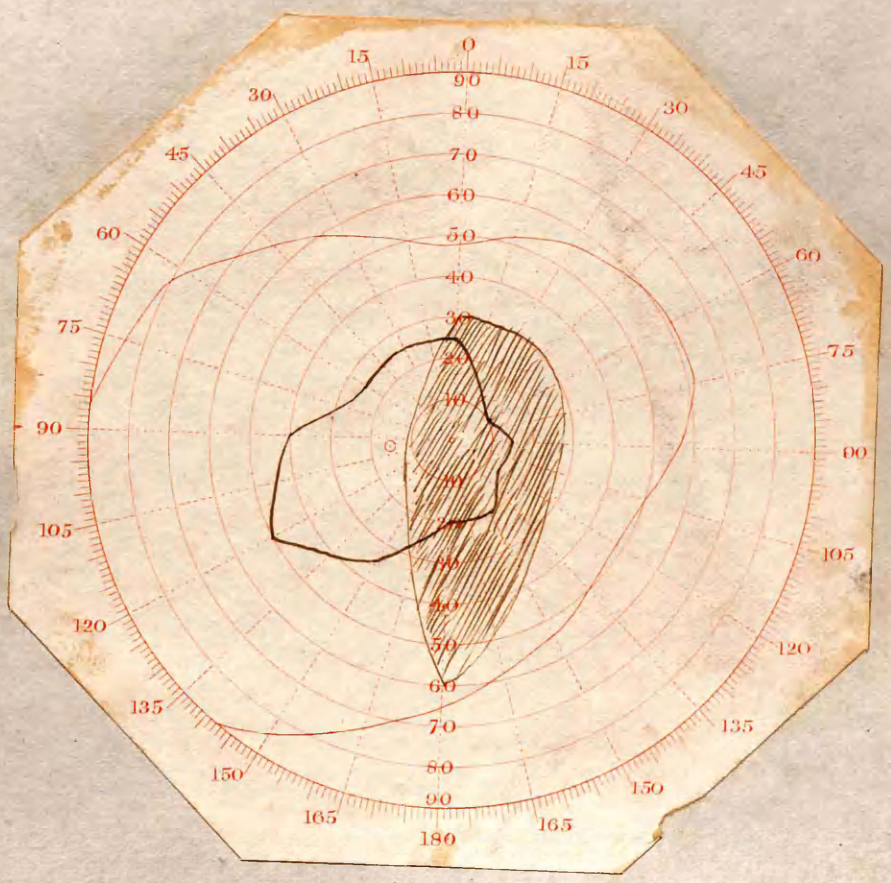


Dec: 18: 86.



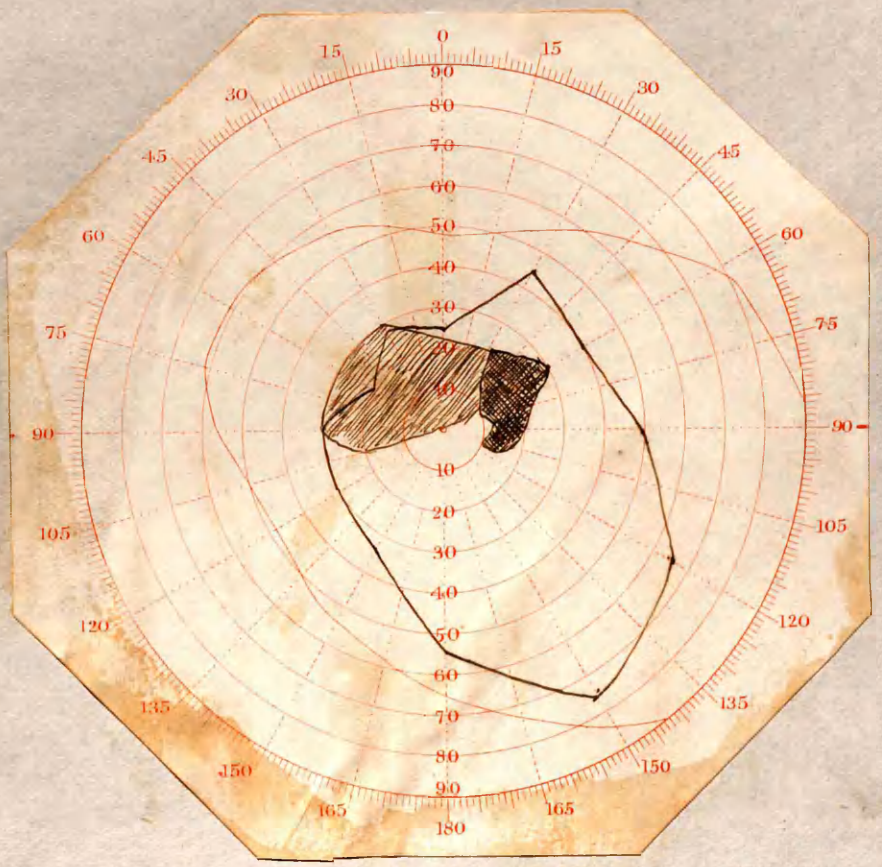
Dec. 18. 86.

A



Jany. 5: 87

A



Jany 5. 87

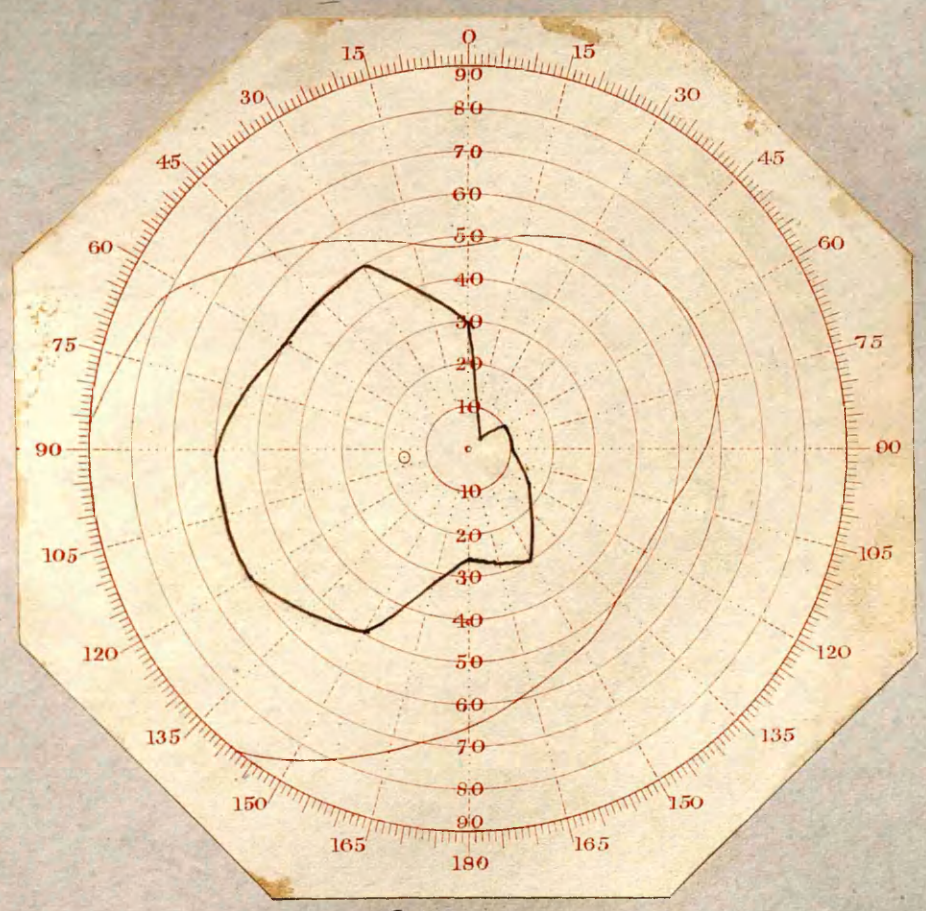
Plate V

Separation of Retina

Andrew F. aet 16. 49588

Case 3. p 28.

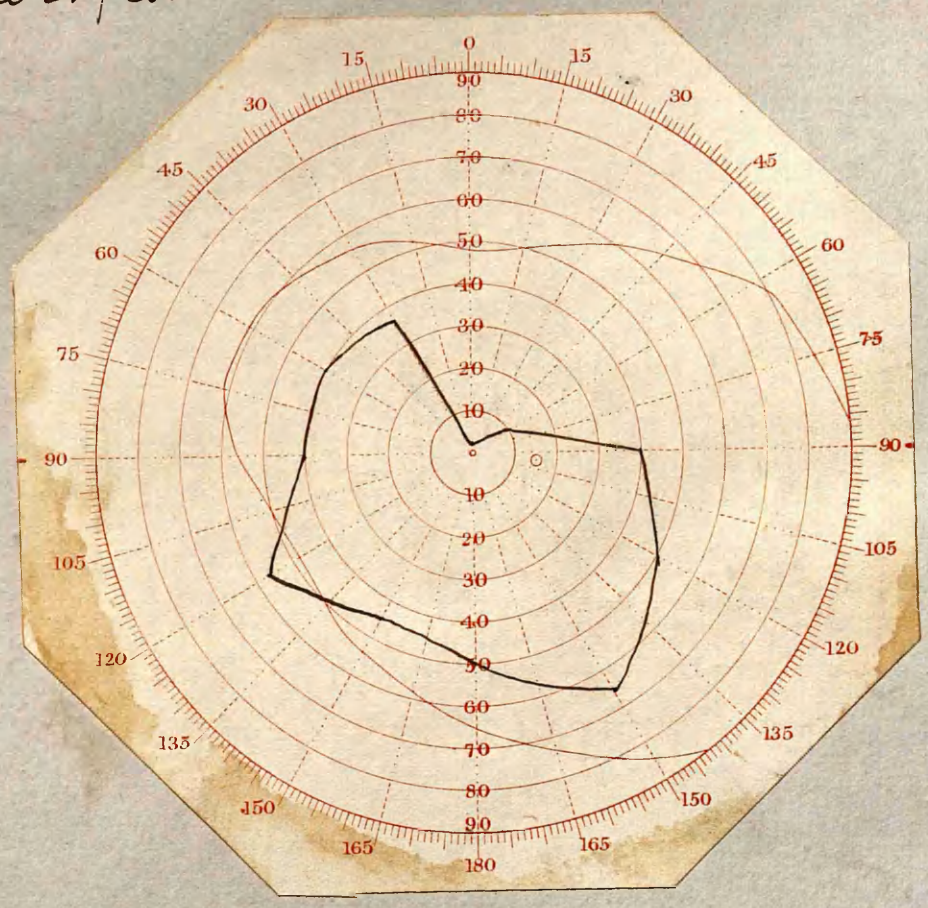
LEFT.



F.

Feb 2 : 1887.

RIGHT.



E.

Feb. 2 : 1887.

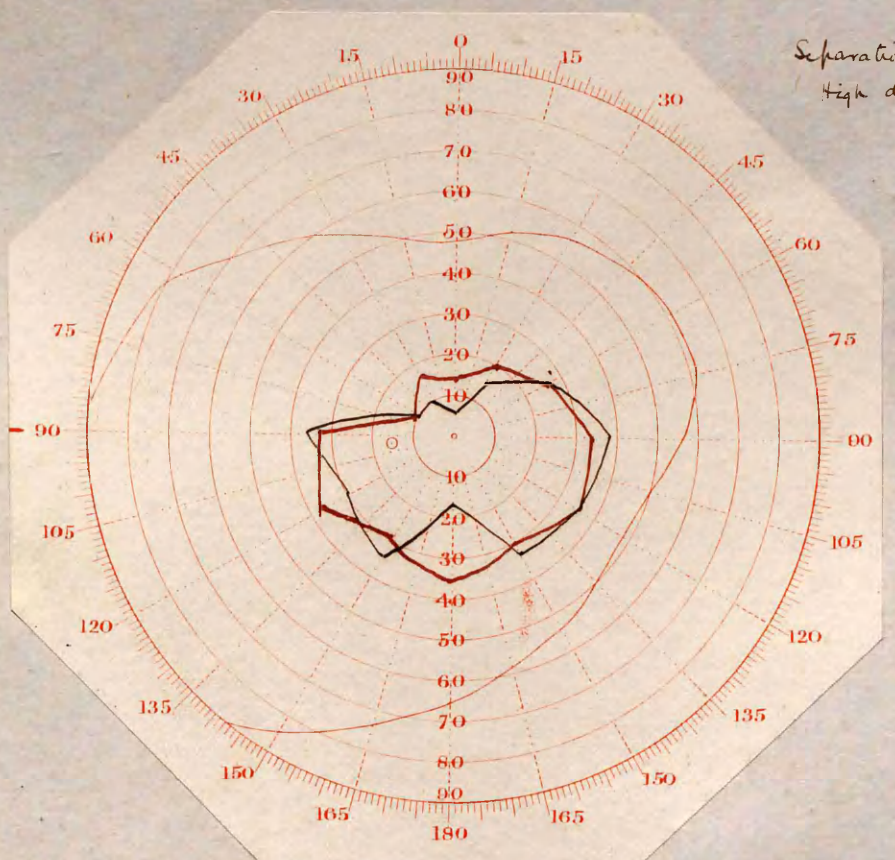
Plate vi

Case 4. p. 30.

Mary. A. act 19. No 49788.

Separation of Retina with High degree of Myopia.

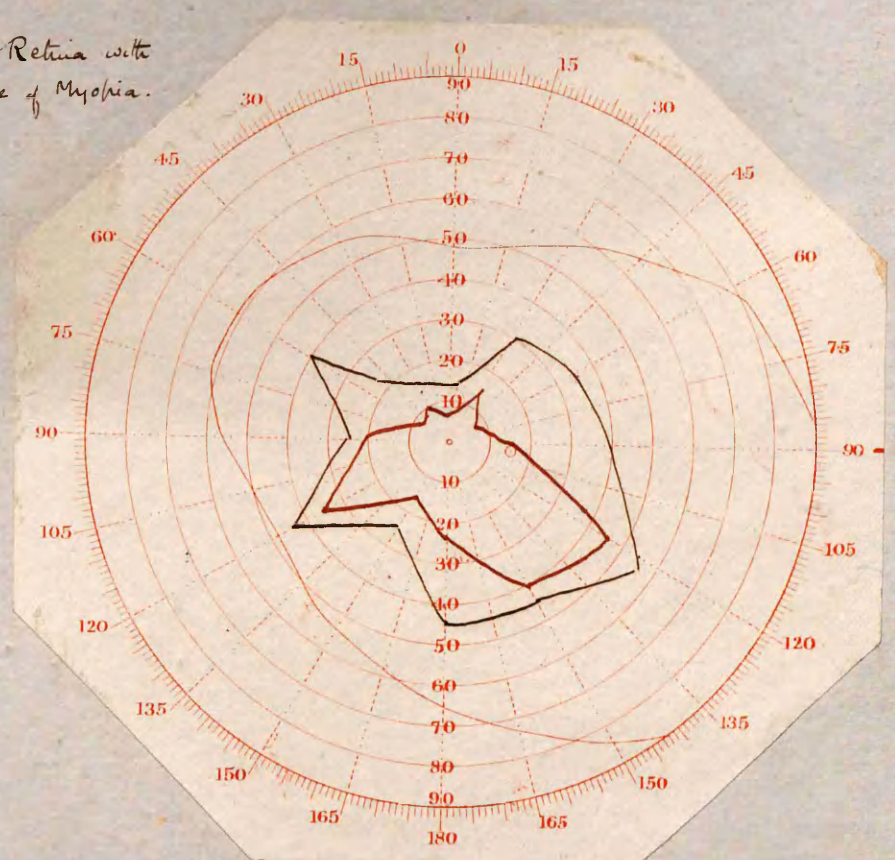
LEFT.



B

— field for white Jany 4 : 87.

RIGHT.



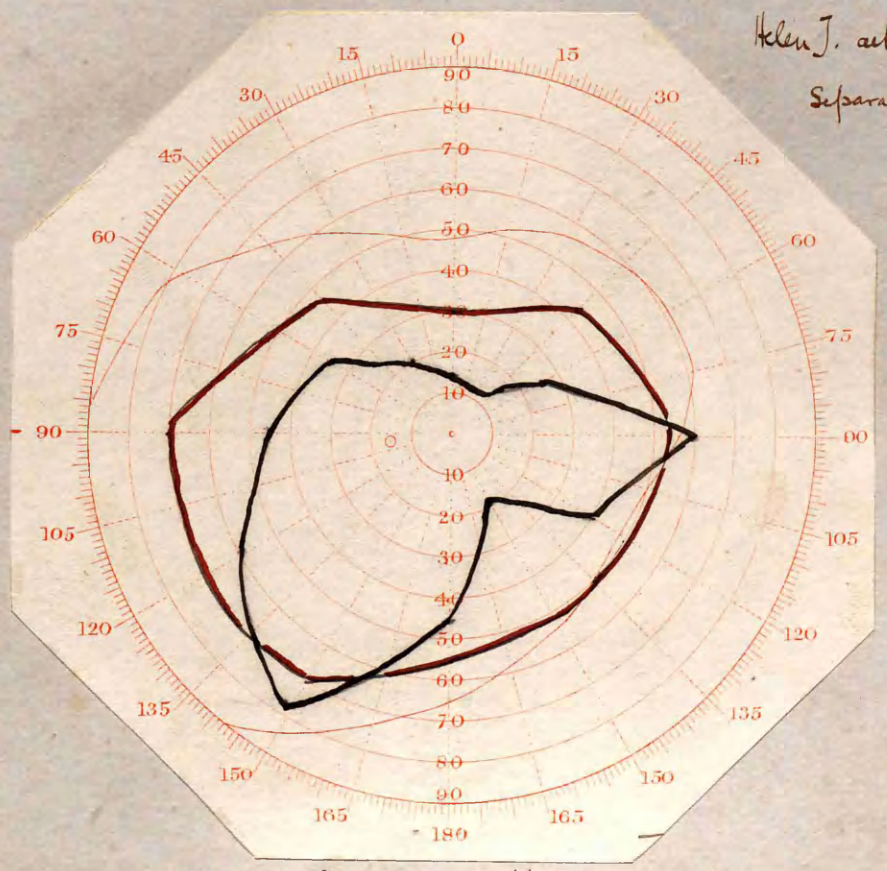
A

— field for white Jan. 28 : 87.

Case 5. p. 31

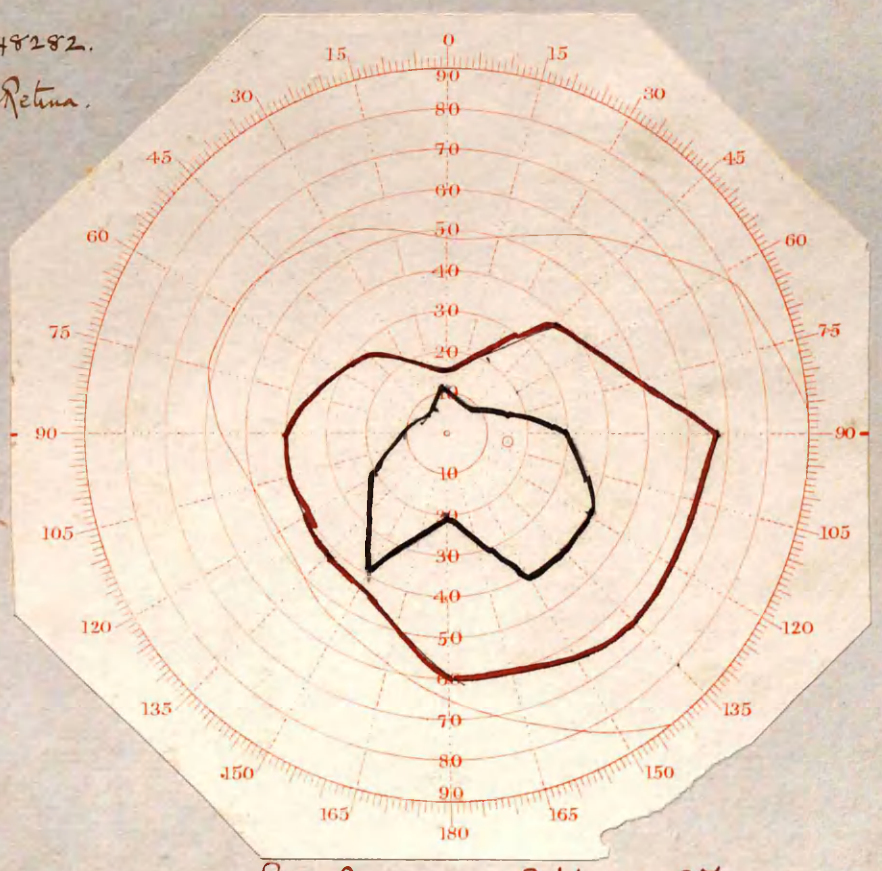
Helen J. act 21. 48282.

Separation of Retina.



D

Field for white. Sept. 1. 87.

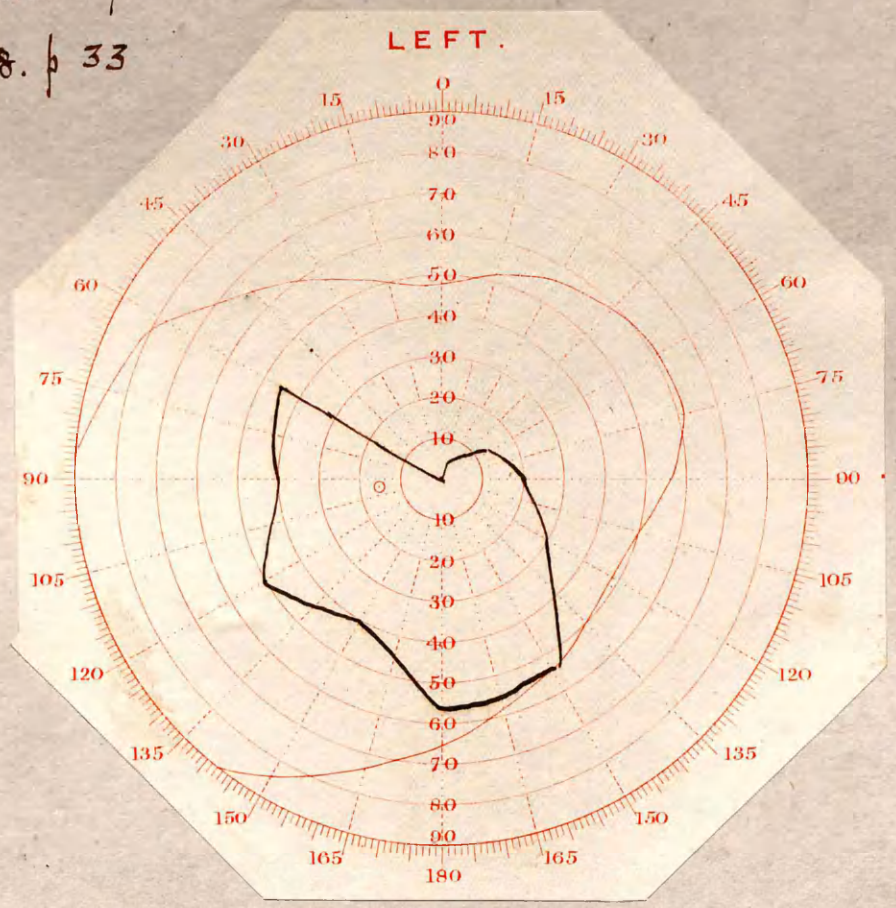


C

— field for white on Sept. 20 : 87.

Thos. F.
46820

Separation of Retina.
Case 8. p 33

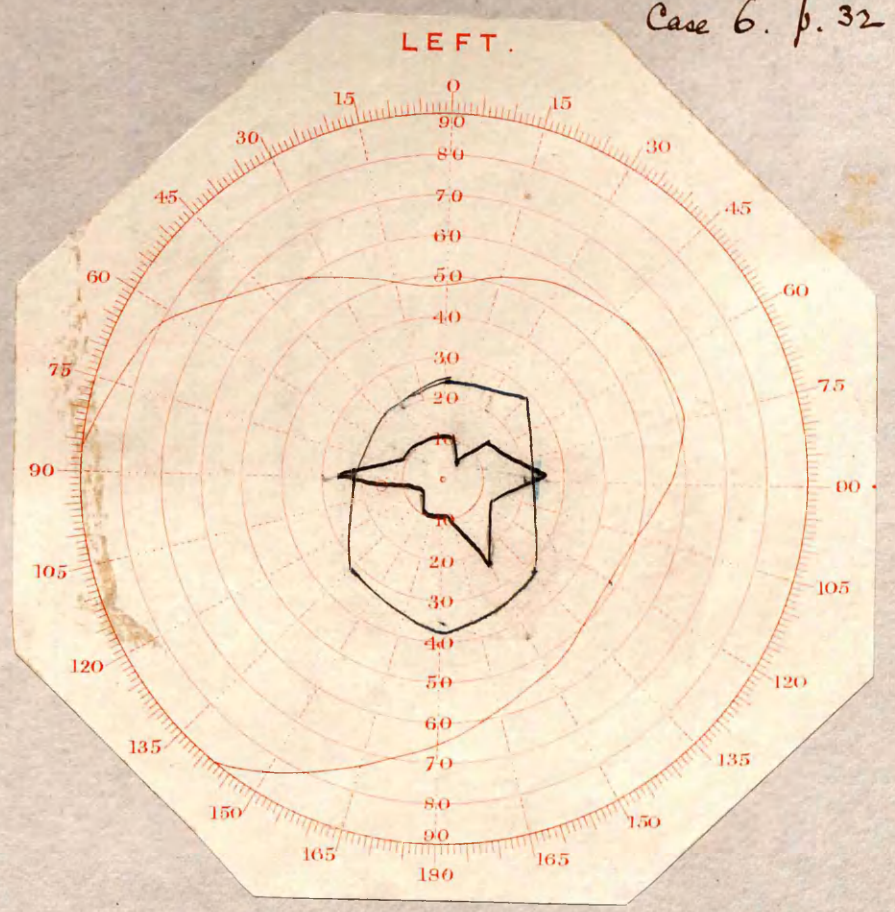


A.

Jas G.

Plate VII

Case 6. p. 32

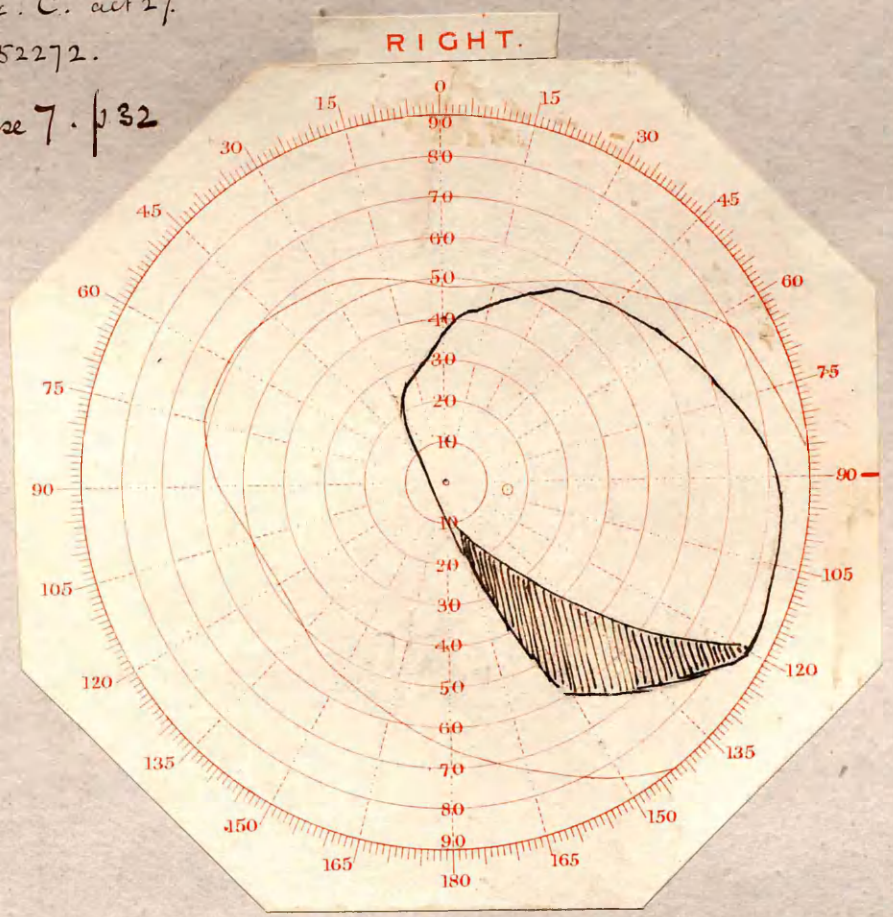


B

Plate VIII

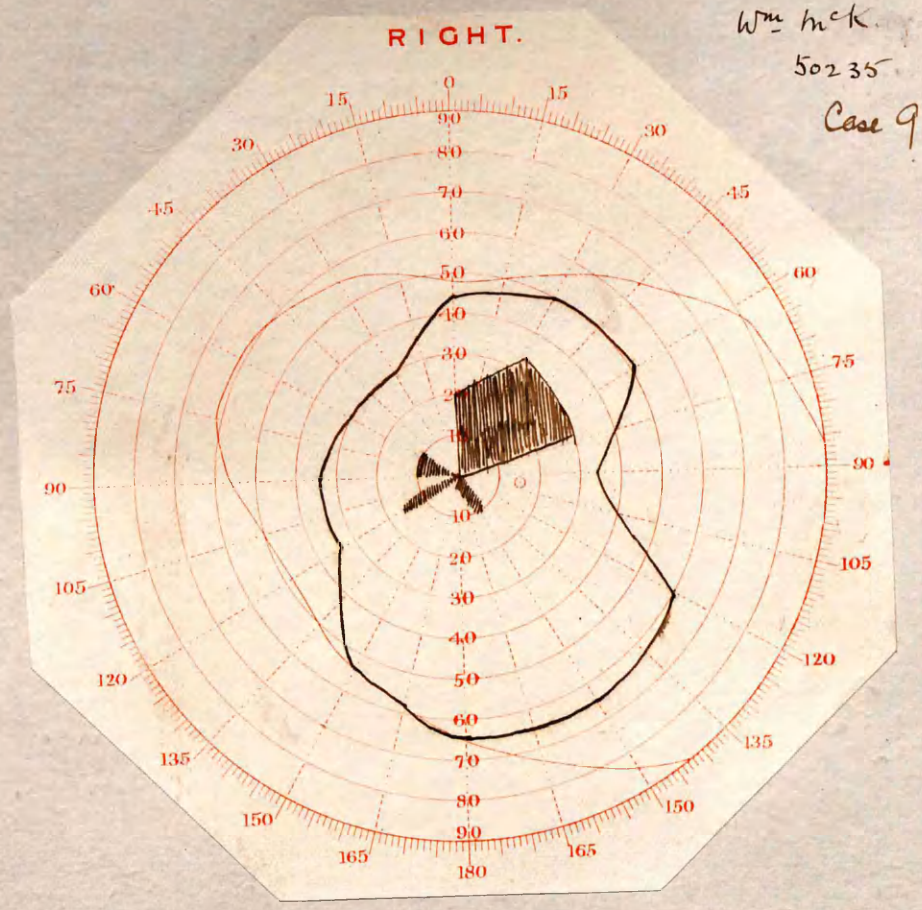
Separation of Retina.

Alex. C. act 27.
52272.
Case 7. p 32



A

Wm McK.
50235
Case 9. p 33

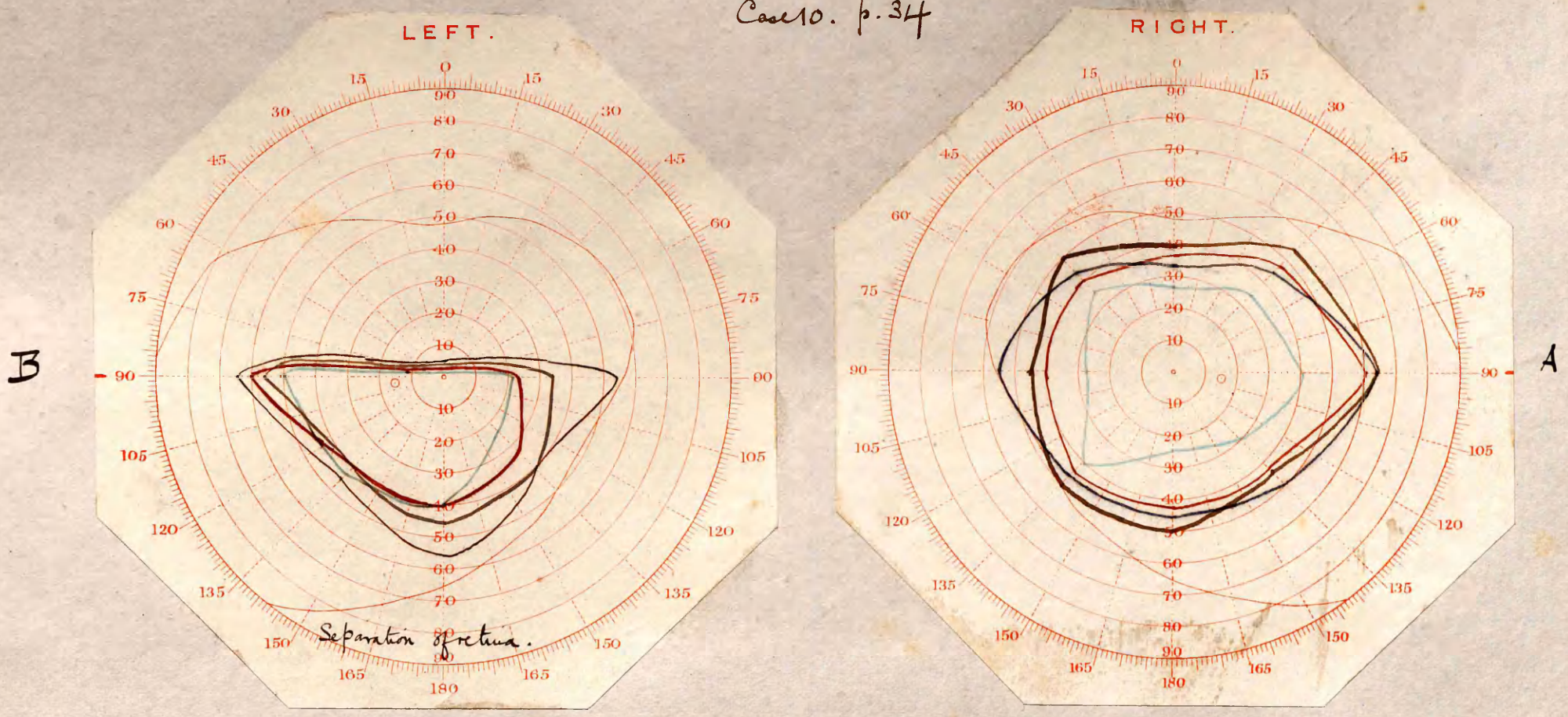


B

Francis McT. aet 39. no 53895.

Case 10. p. 34

Plate IX



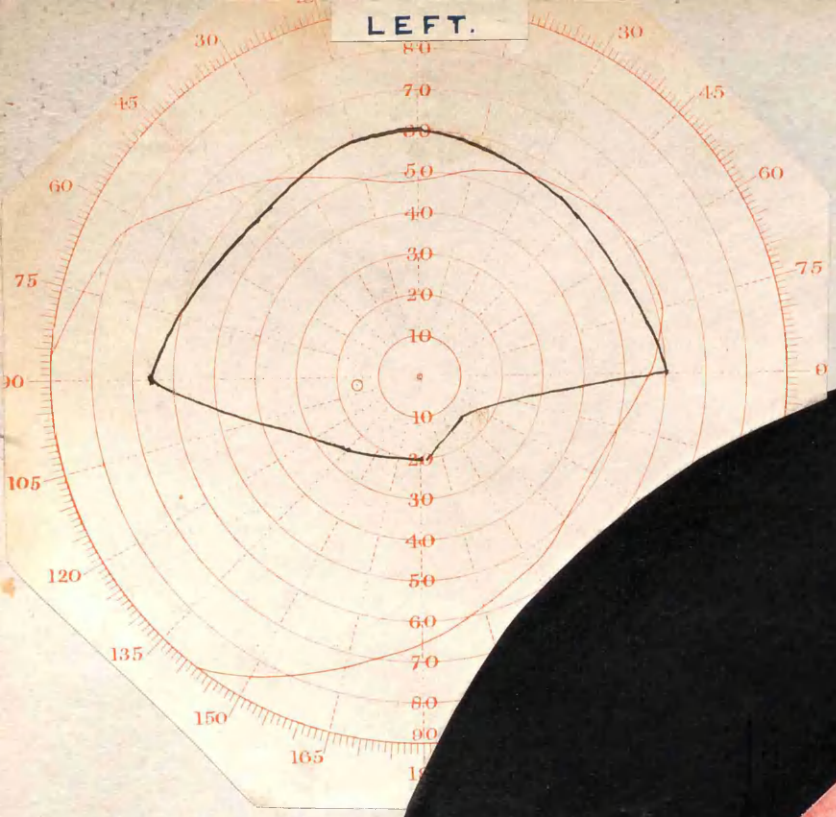
case 11. p. 36.

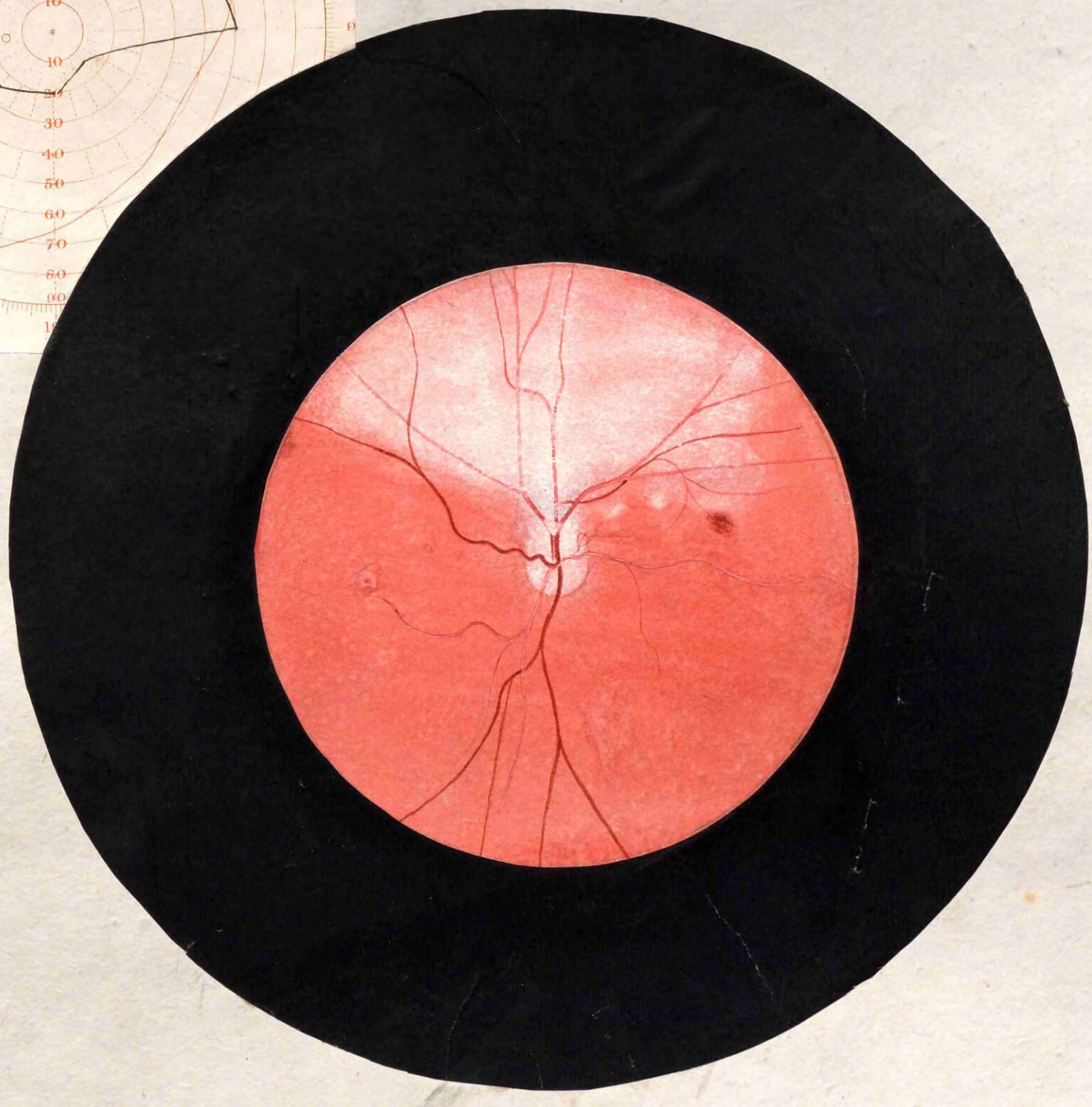
Lizzie Mc. A. aet: 19

no. 56273.

Plate: X

Embolism of Central Artery of Retina.





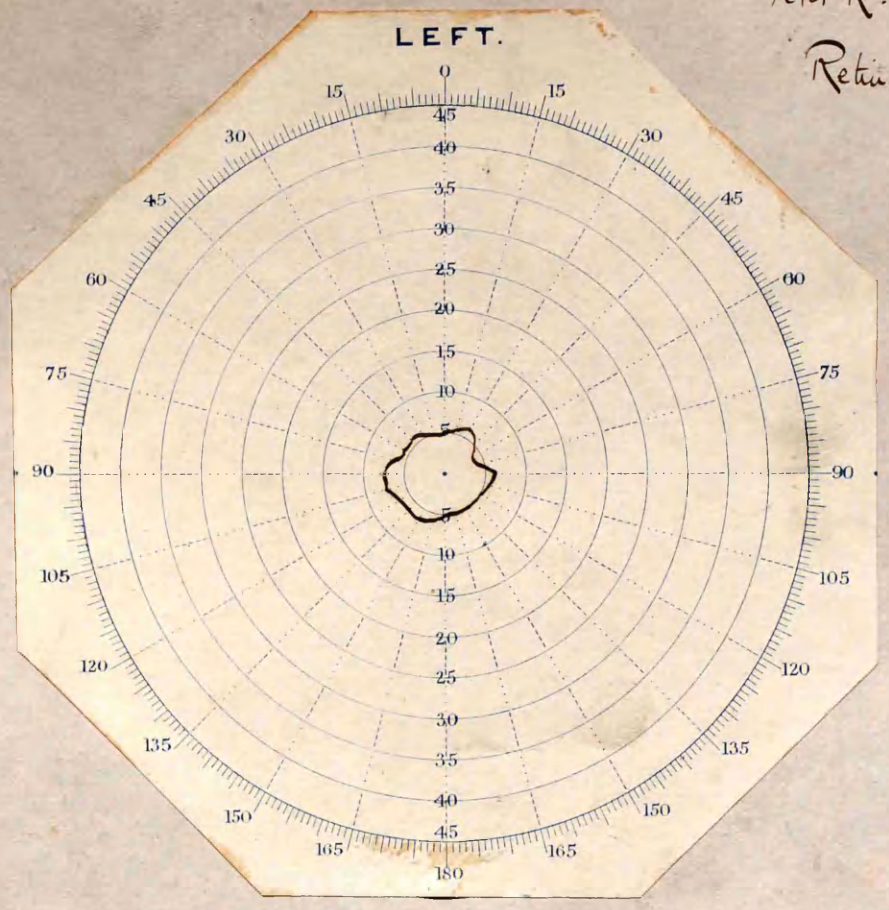
Left Eye.

Case 12. p. 38

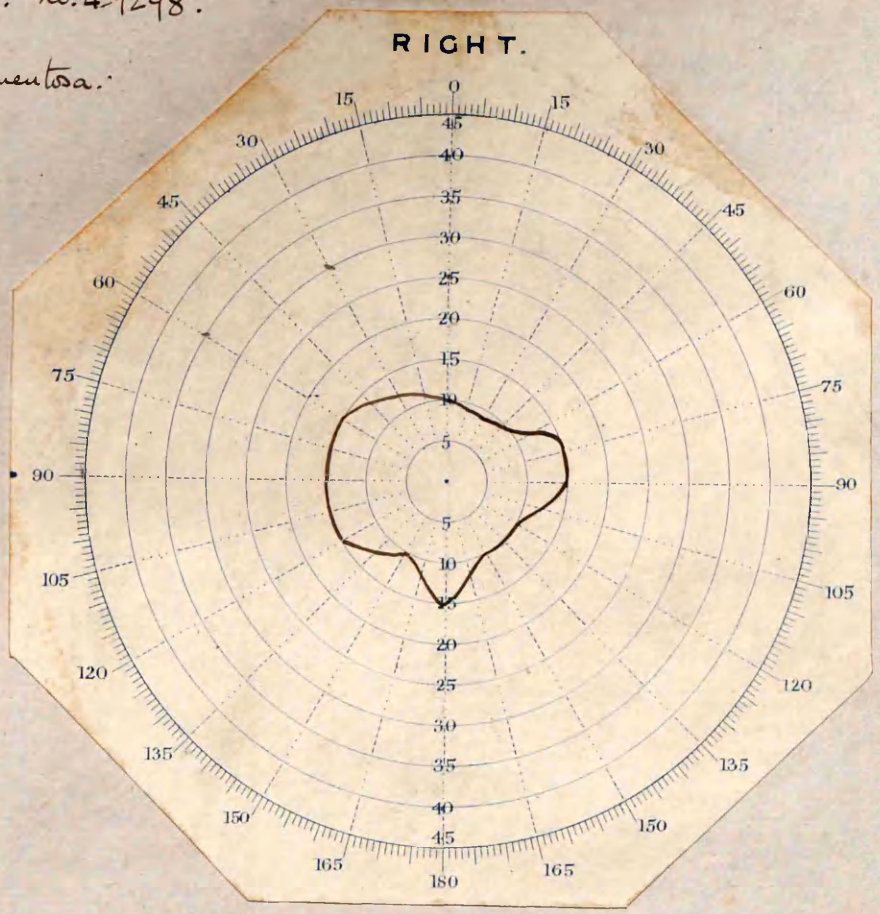
Peter R. aet. 40. no. 49298.

Retinitis Pigmentosa.

Plate XI



B

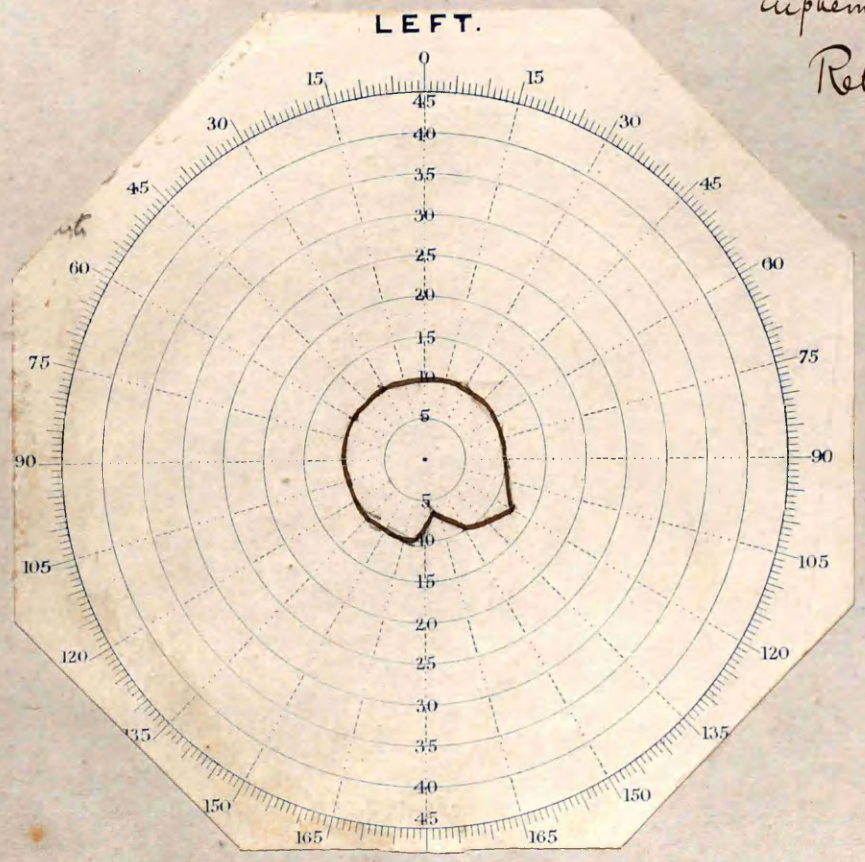


A

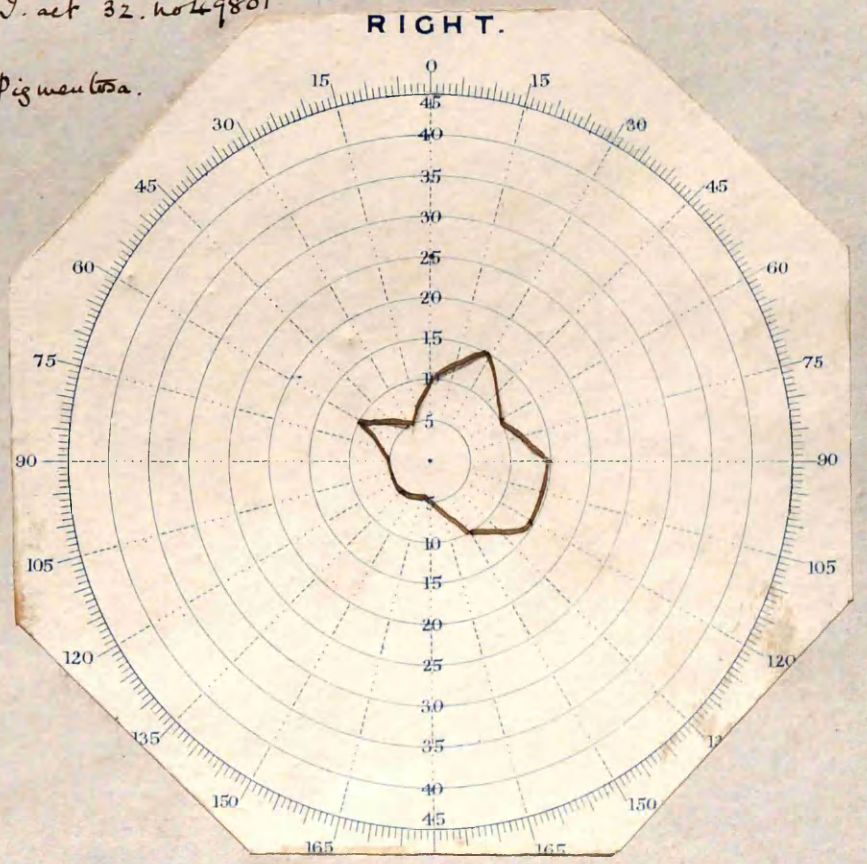
Case 13. p. 39

Euphemia McI. aet 32. no 49801

Retinitis pigmentosa.



D



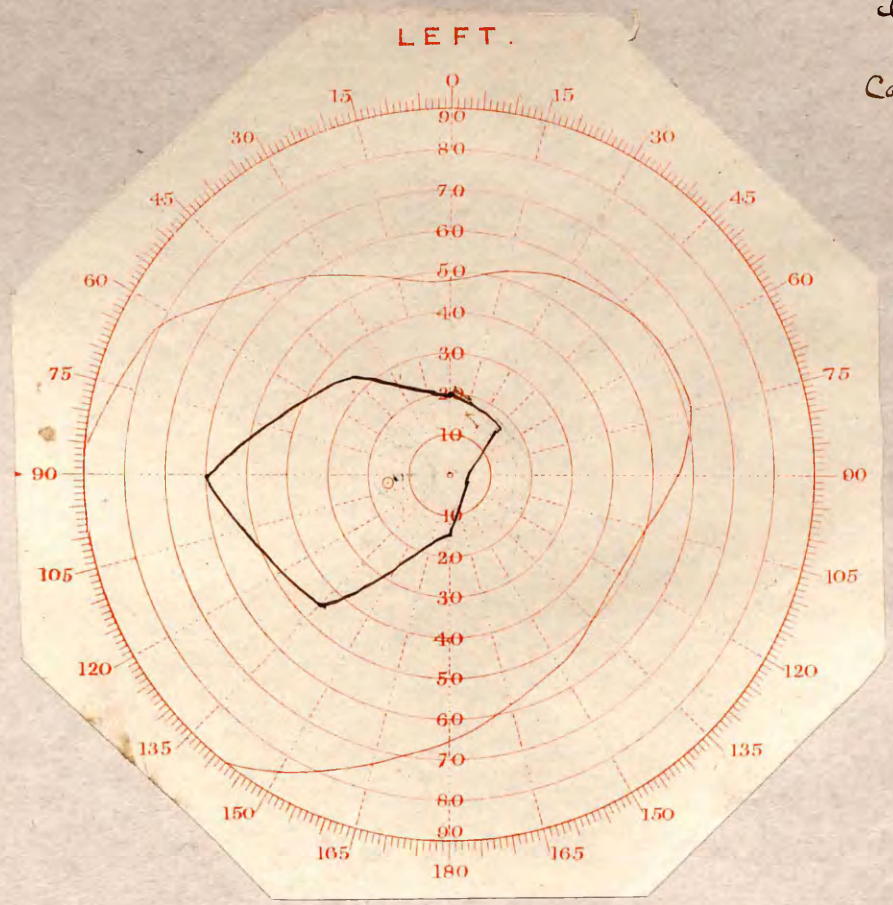
d

Plate XII

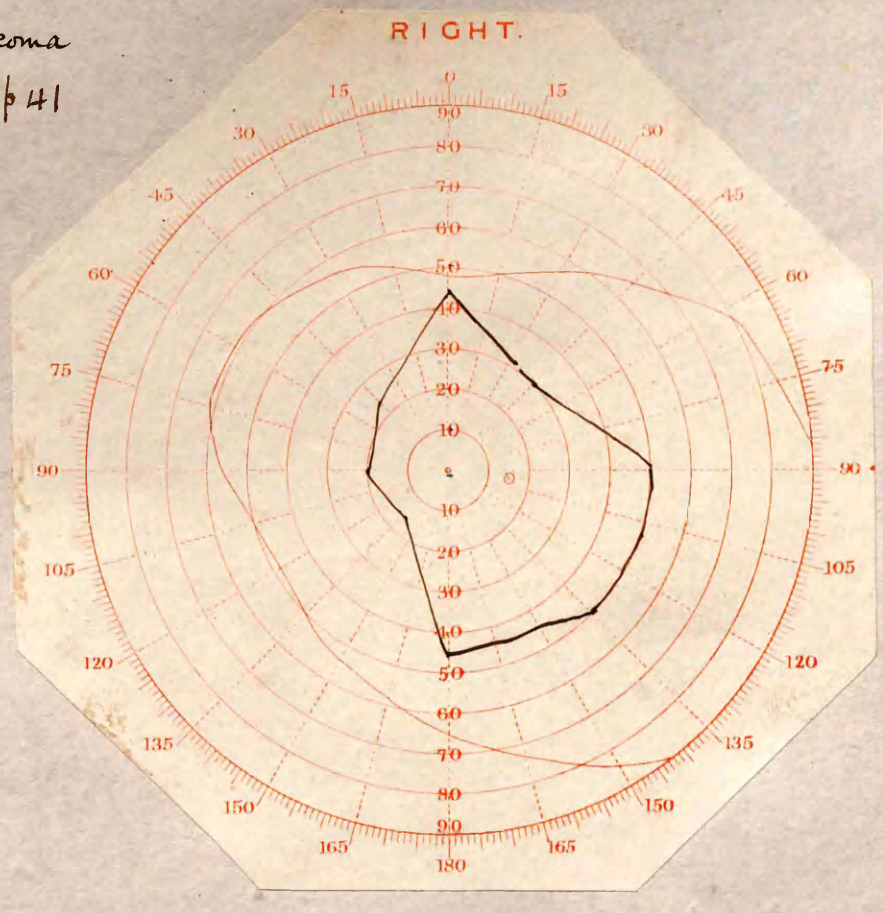
Margt McK. aet 60. no 54895

Glaucoma

Case 14. p 41



B

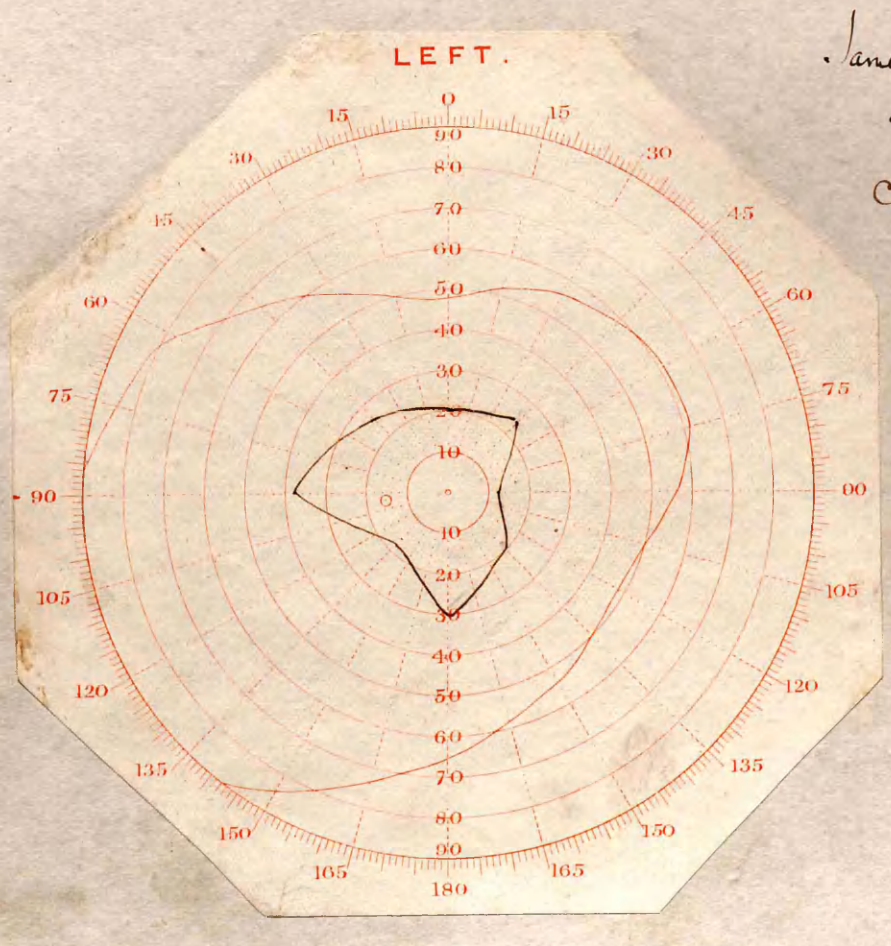


A

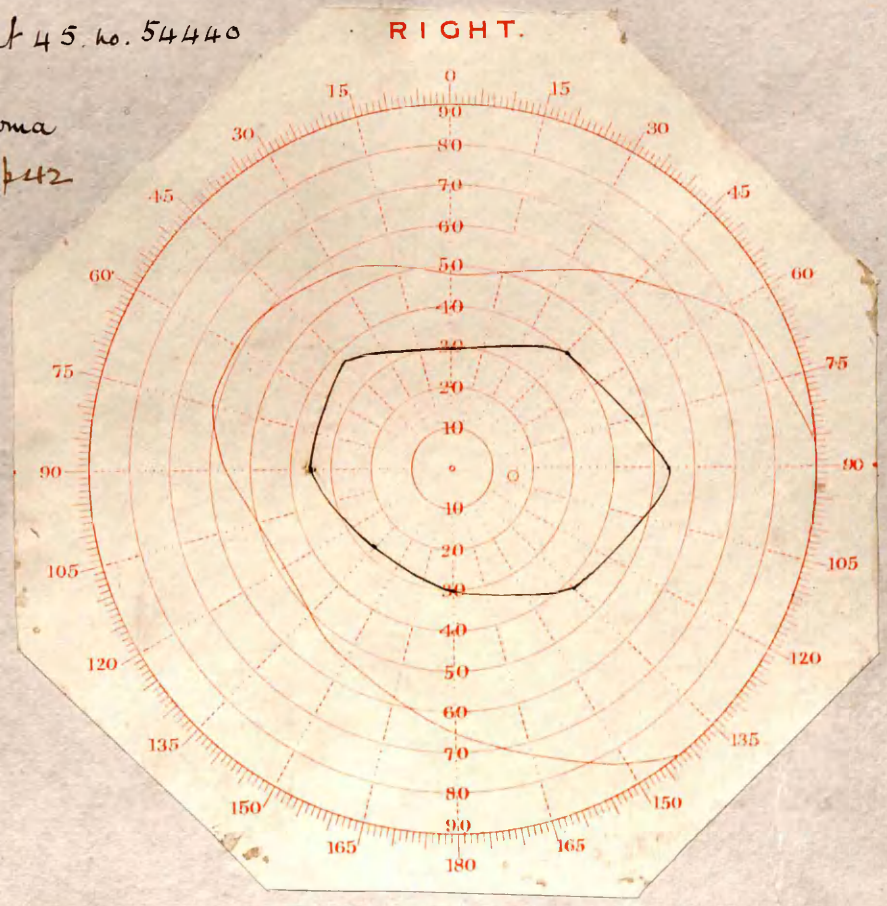
James B. aet 45. no. 54440

Glaucoma

Case 15. p 42



D



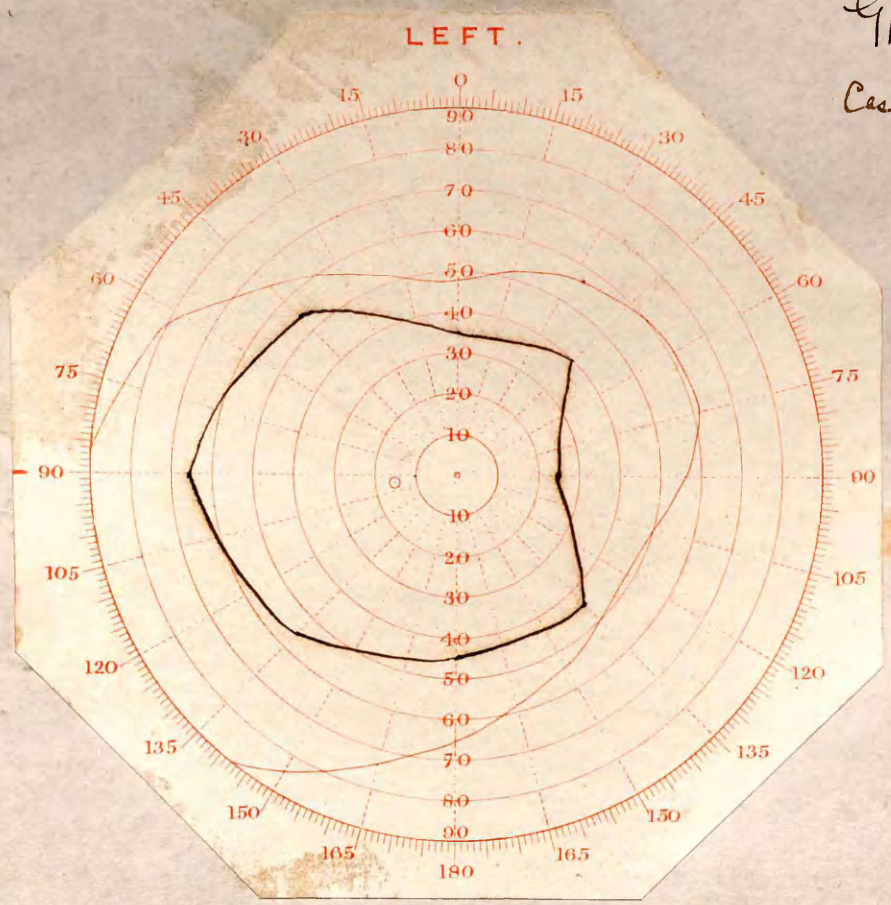
C

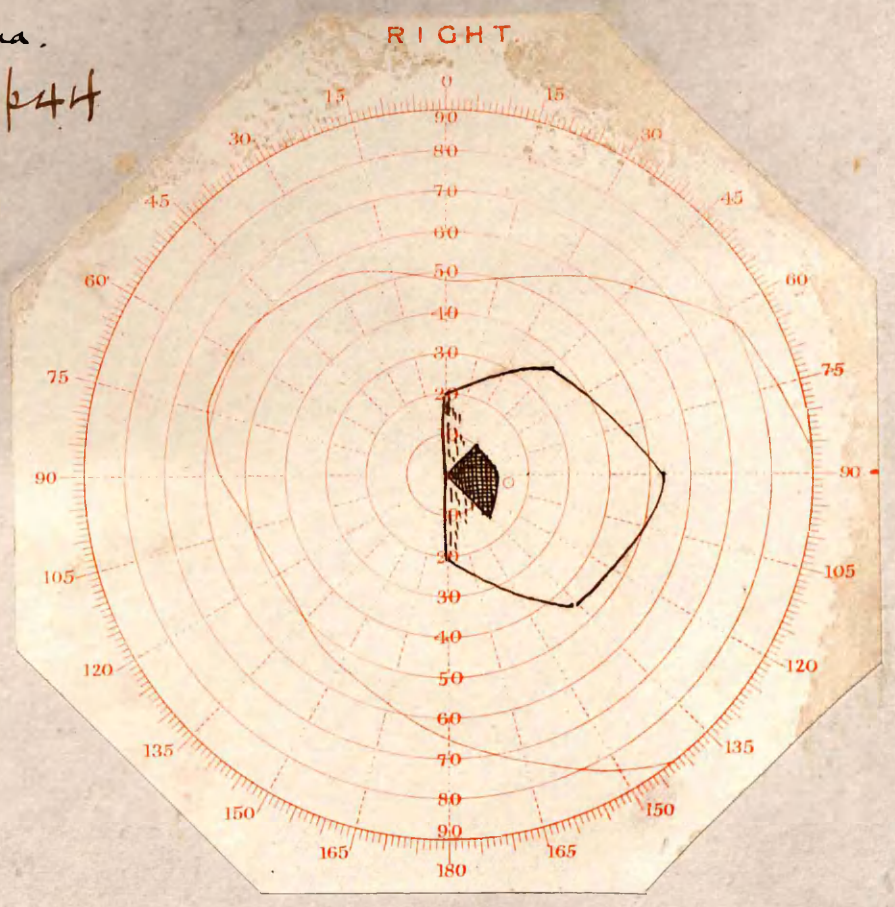
Plate XIII

Henry B. aet 51. no. 54231

Glaucoma.

Case 16. p44





A

Plate XIV

Joan B. aet. no.

Case 17. p48

Chorioditis disseminata

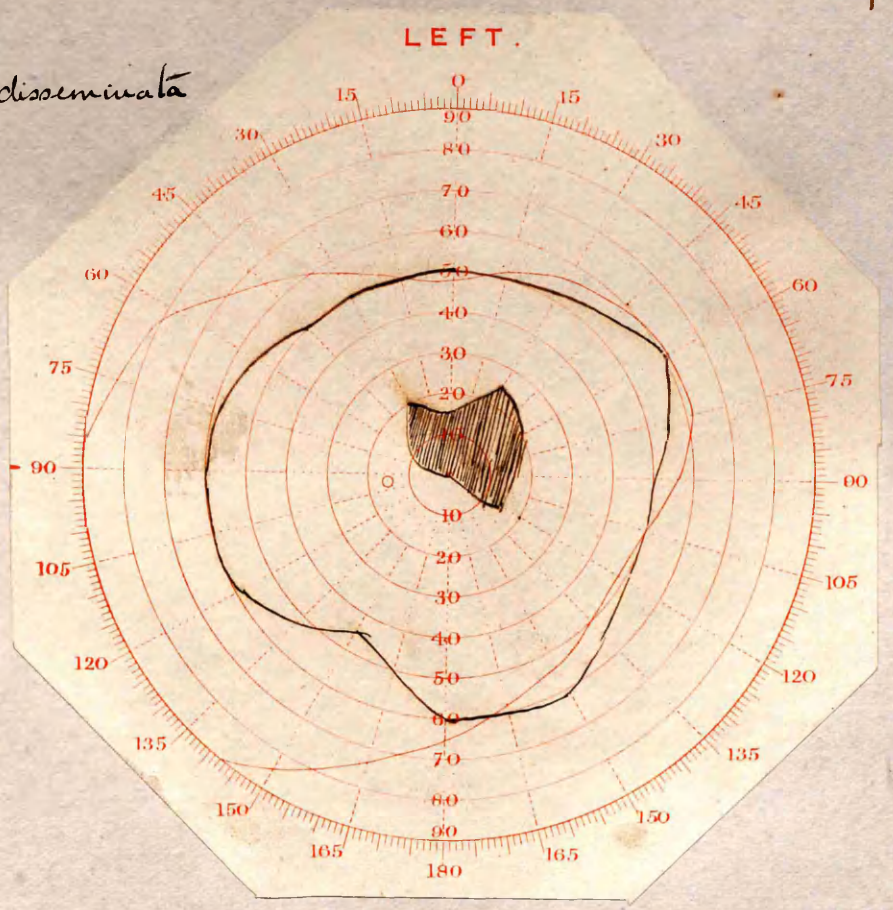


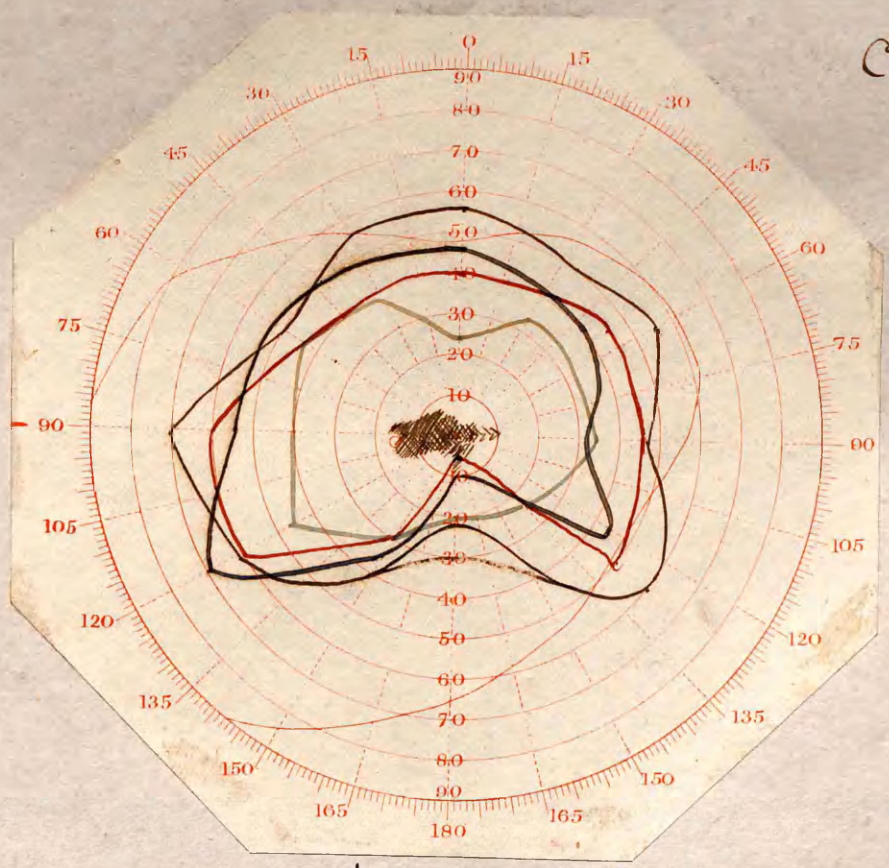
Plate XV

Jas McG. act. 22 no 52813.

(1)

Case 18. f56

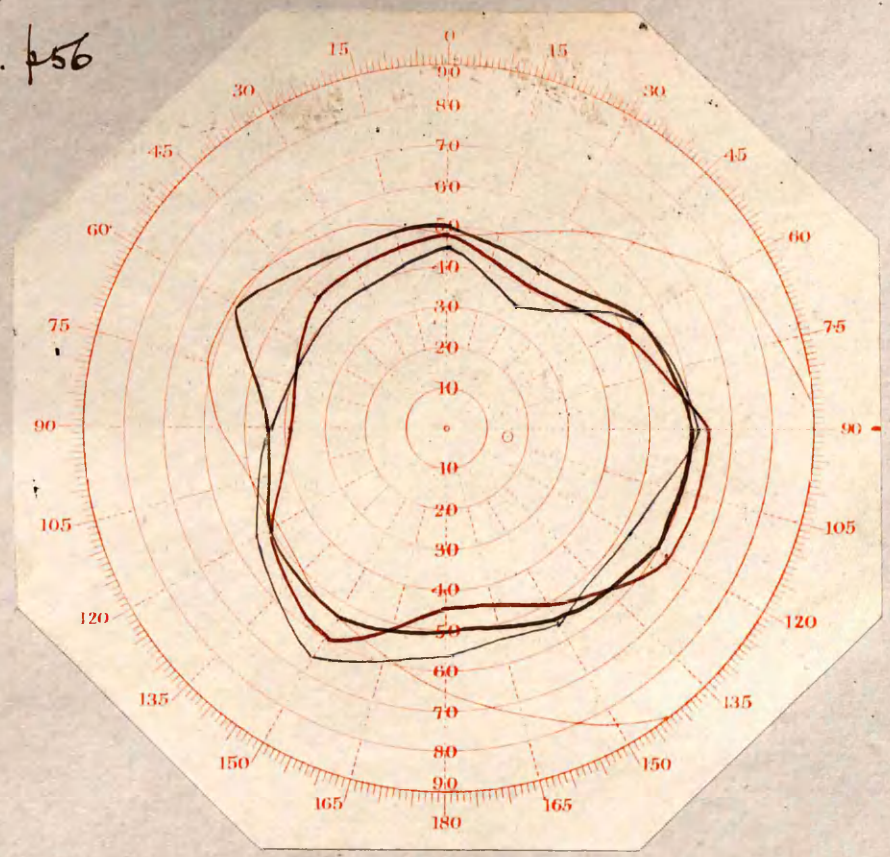
LEFT.



C

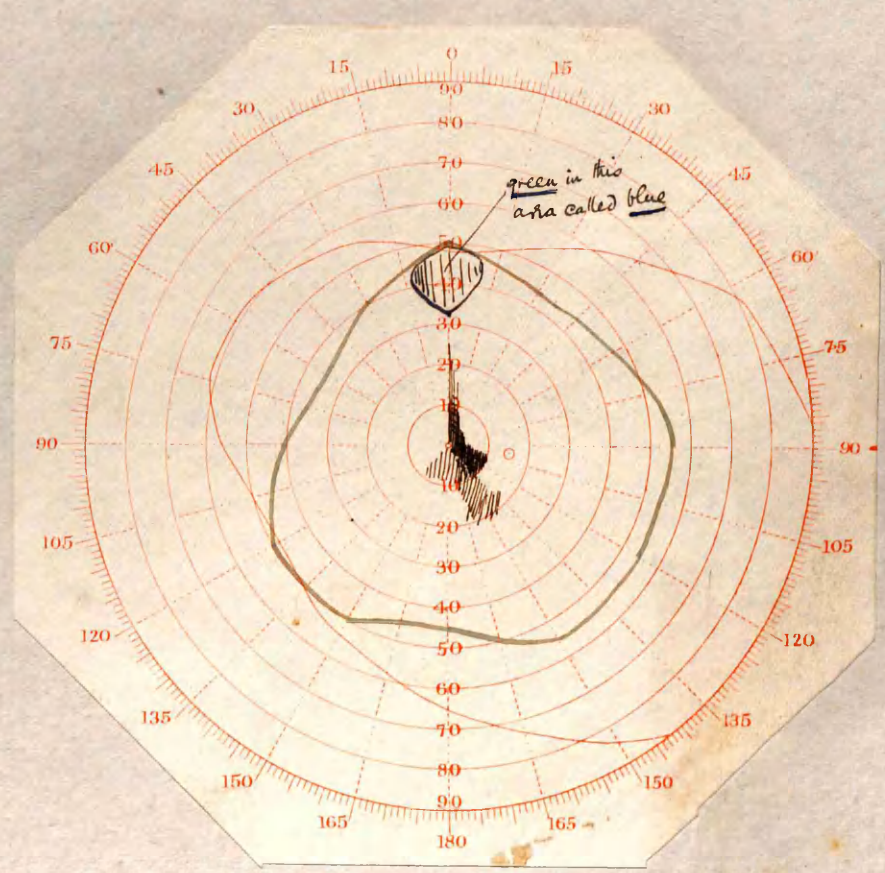
July 25 : 1887

RIGHT.



A

July 25 : 1887



B

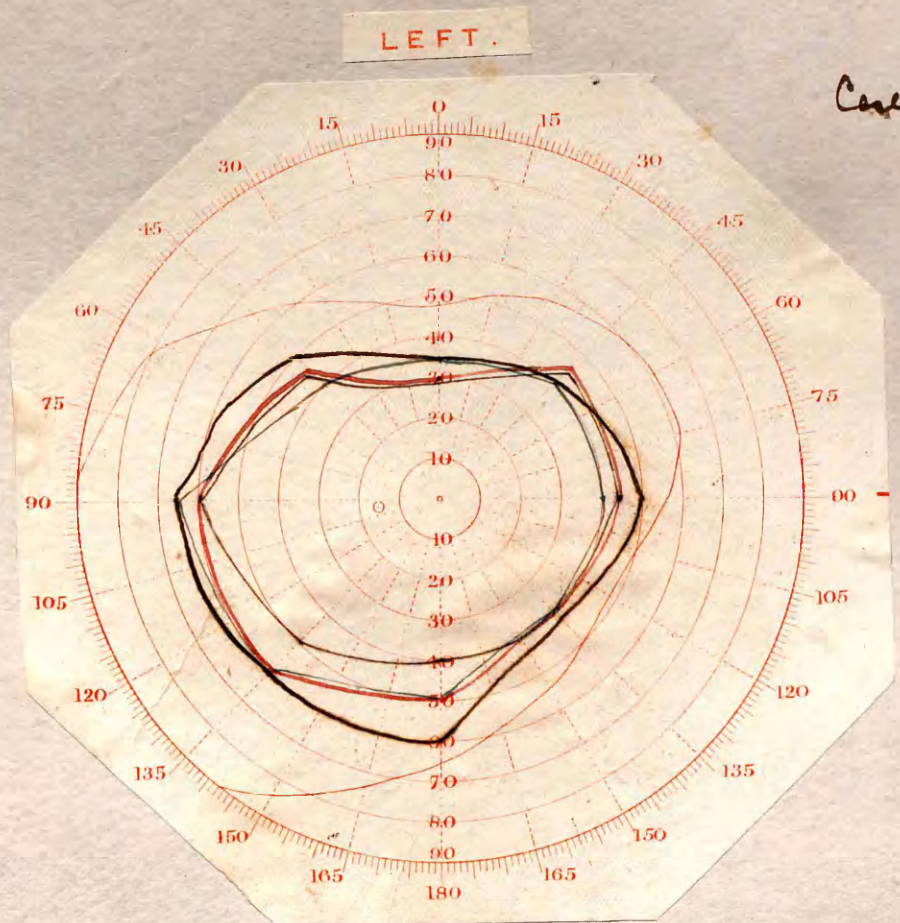
July 25 : 1887.

Plate XVI

Jas McG. aet. 22 No 52813

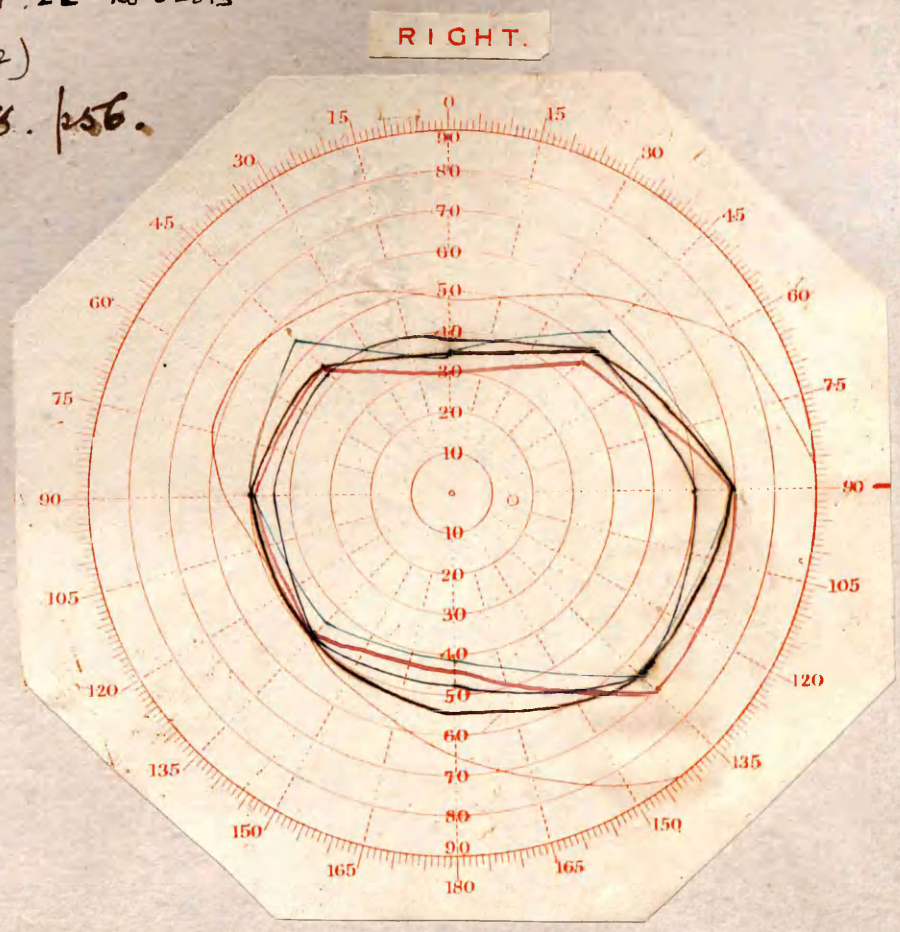
(2)

Card 18. p56.



Blue called green : and green called Blue.

March 24 : 1888



green called yellow.

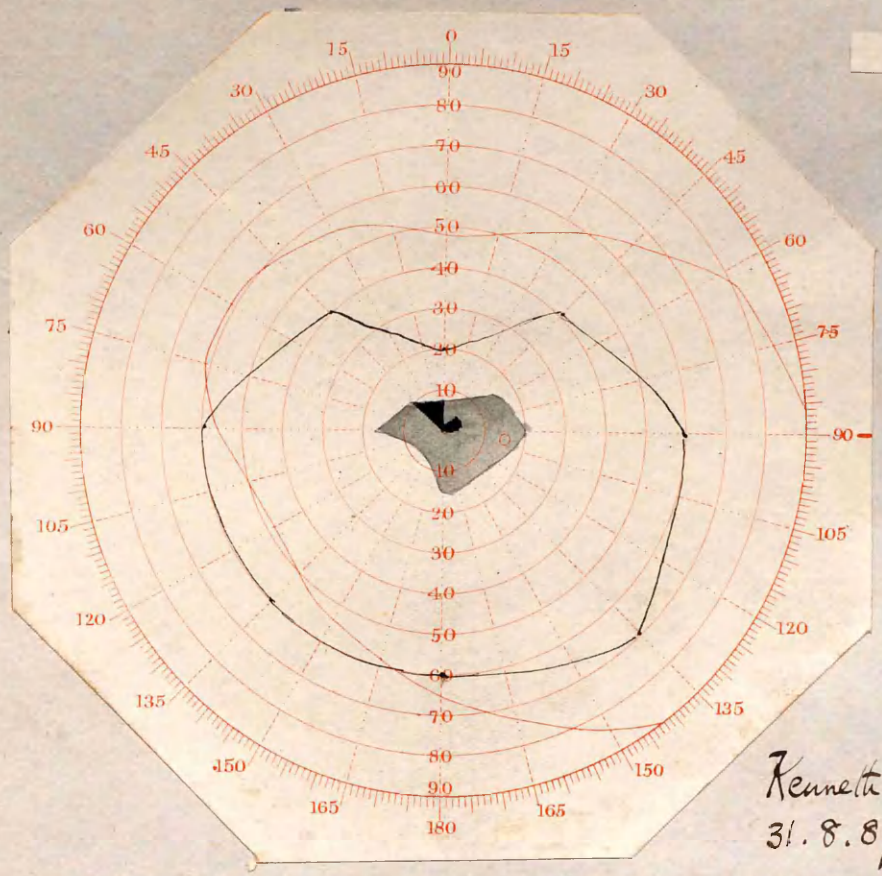
March 24 : 1888.

Case 19. p60.

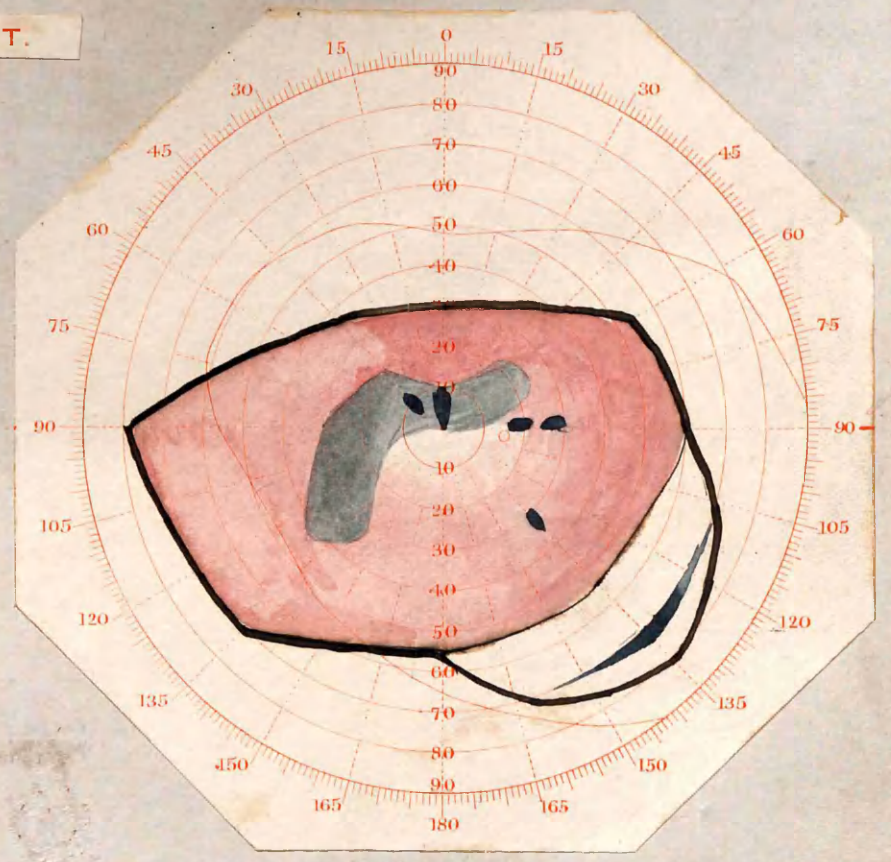
Plate XVIII.

RIGHT.

A



C



WHITE

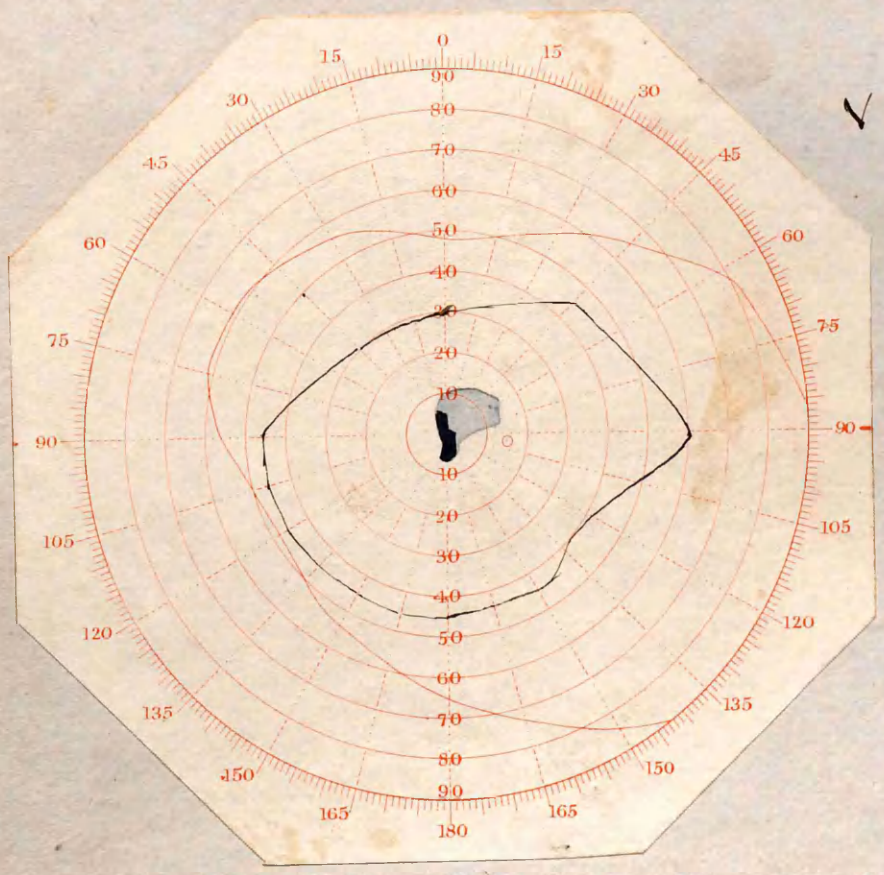
Kenneth M. S.
31.8.87.

Tobacco amblyopia.

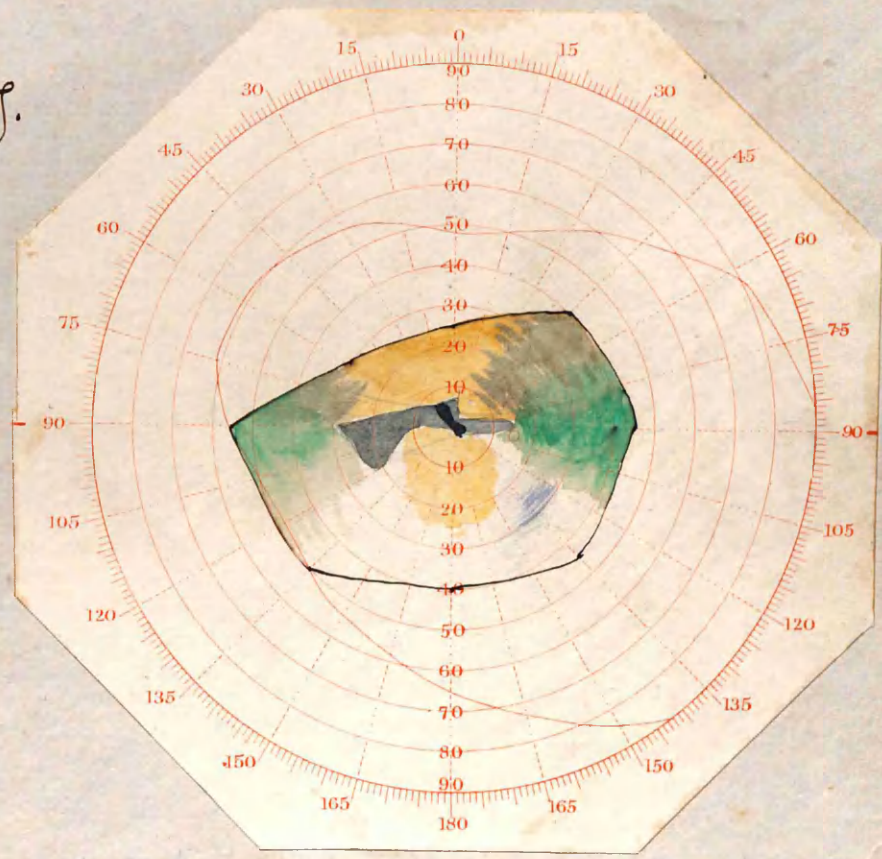
Red:

V = 20/.

B



D



BLUE

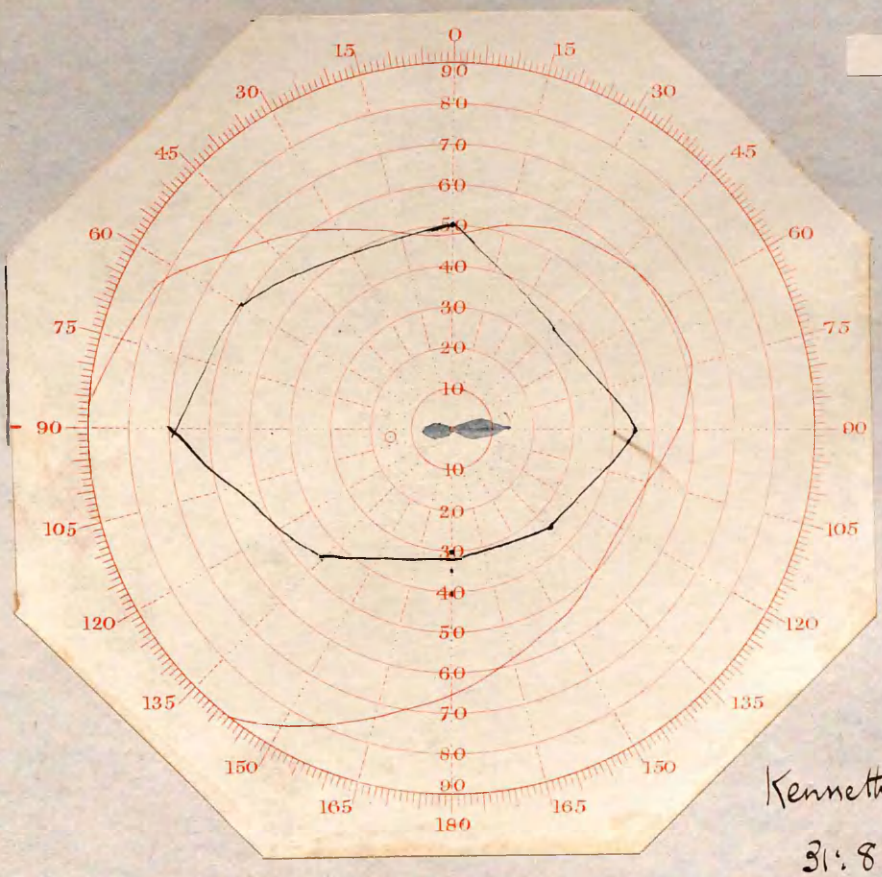
GREEN

Case 19. p60.

Plate XVIII.

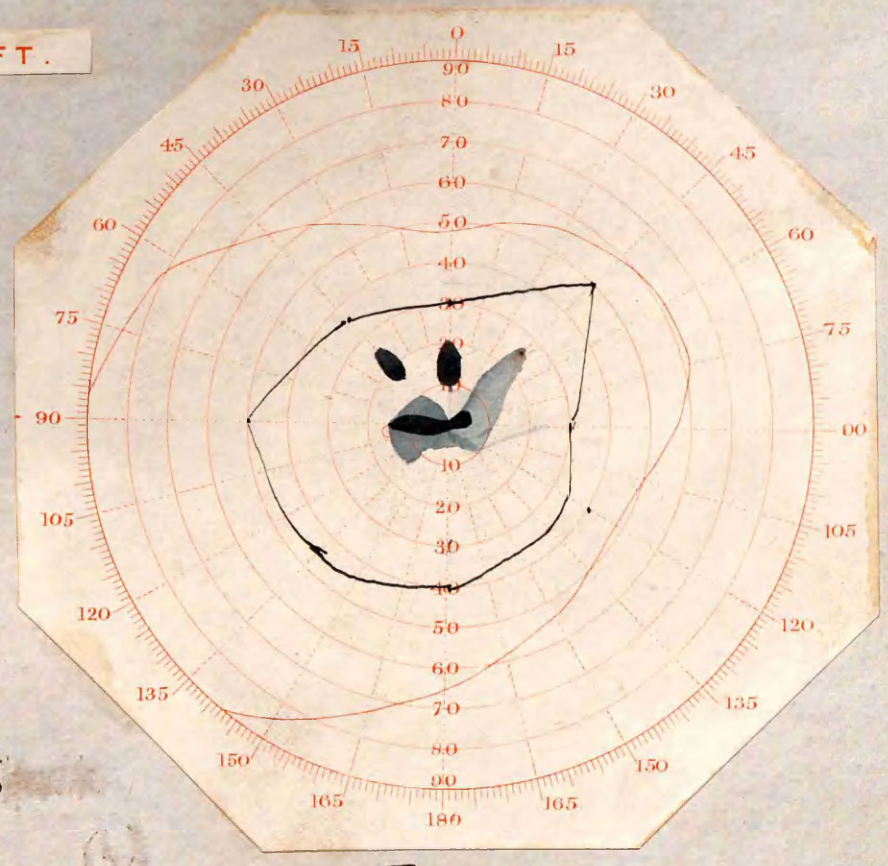
LEFT.

A



WHITE

C



RED

Kennetta M.S

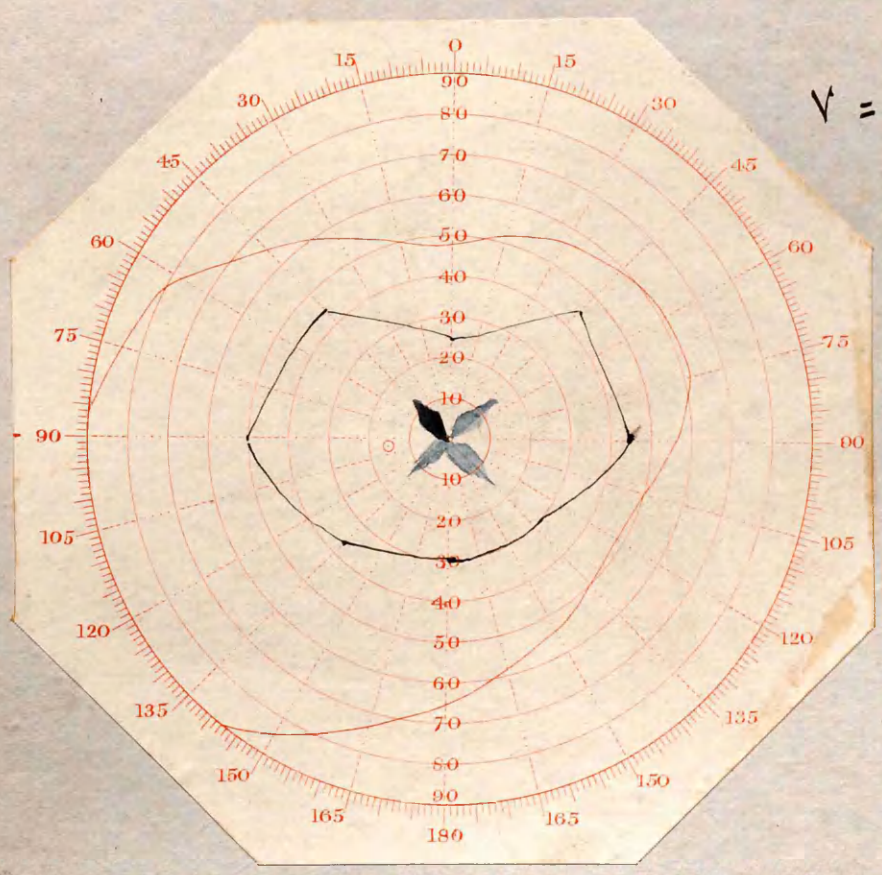
31:8:87.

—

Tobacco Amblyopia.

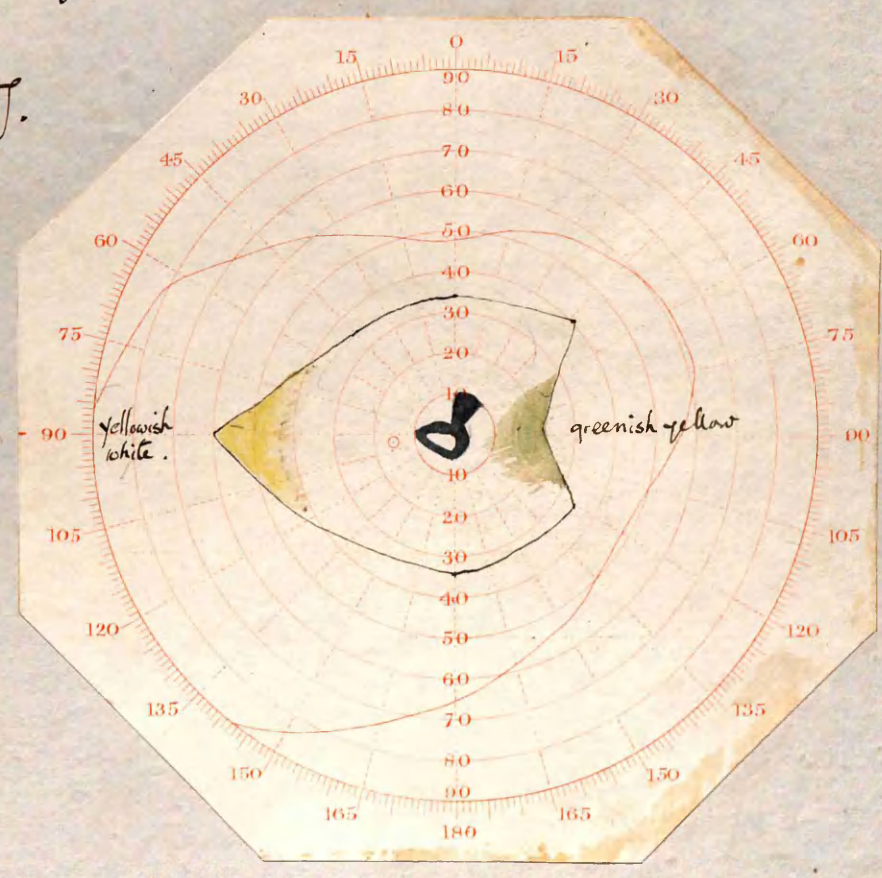
V = 20 J.

B



BLUE.

D



GREEN.

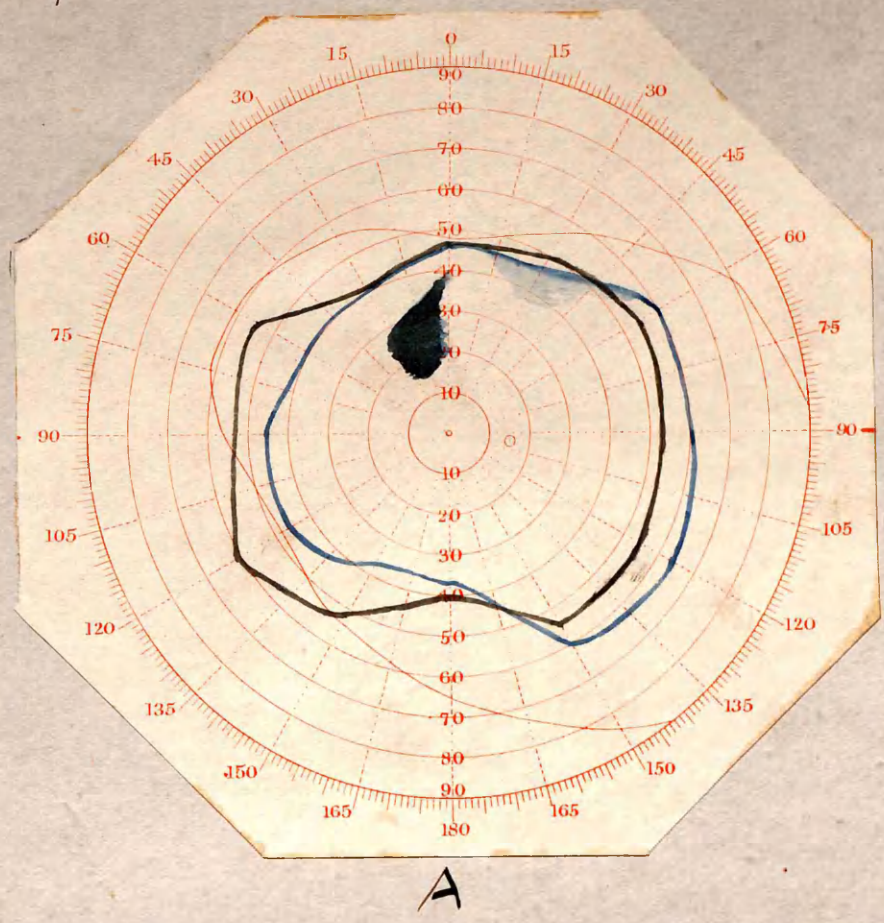
whole field seen as white except in the 2 portions marked.

Plate XIX

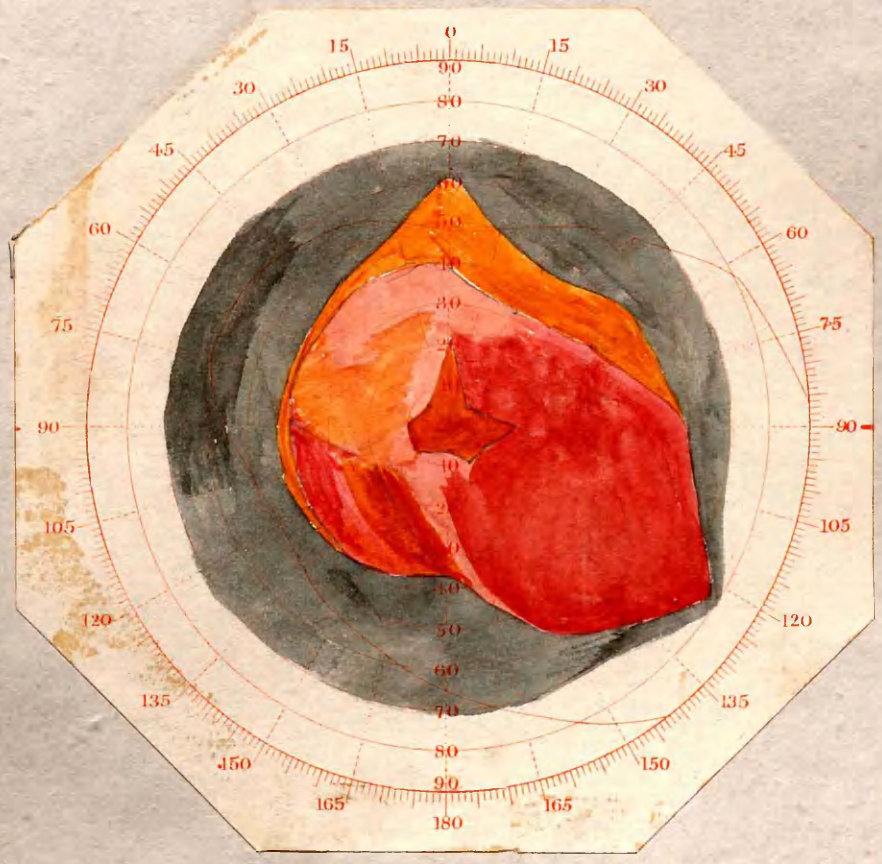
Geo. McC. aet. 55. no 52711.

Tobacco Amblyopia

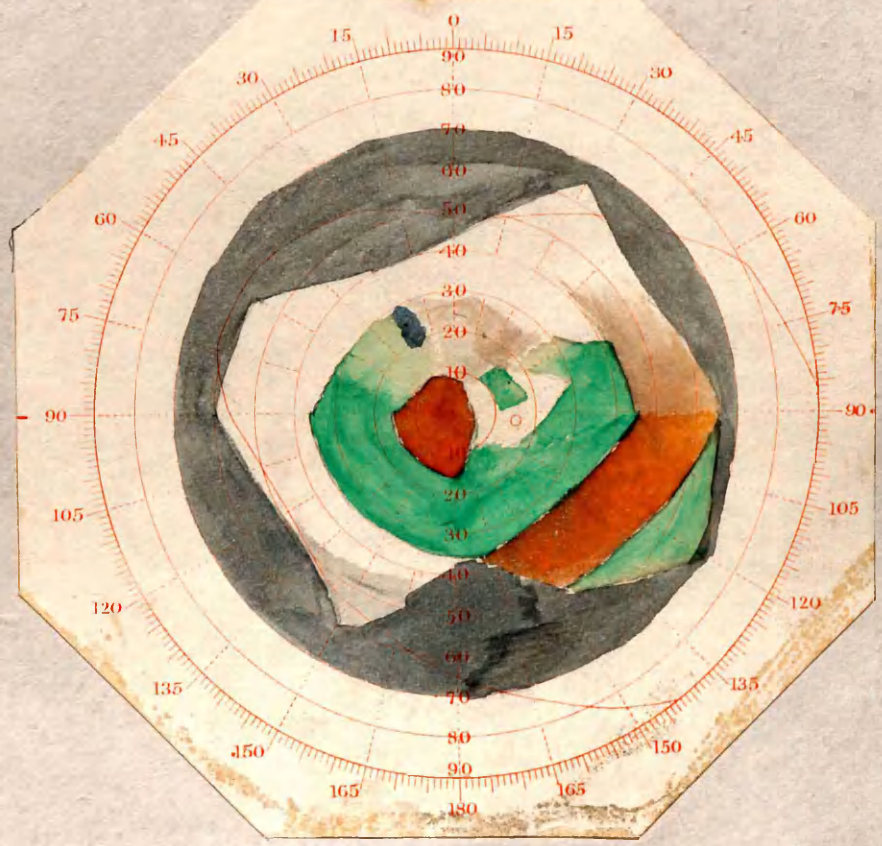
Case 20. p63



A



B



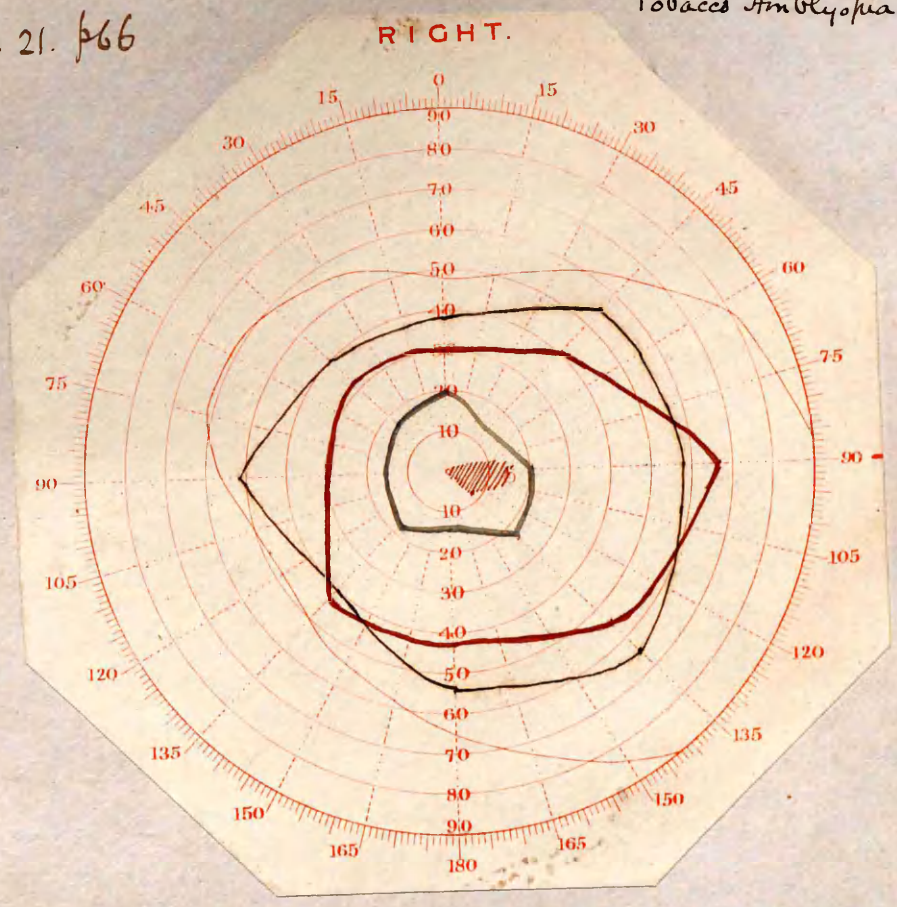
C

Plate XX

John J. aet 35. no. 54782

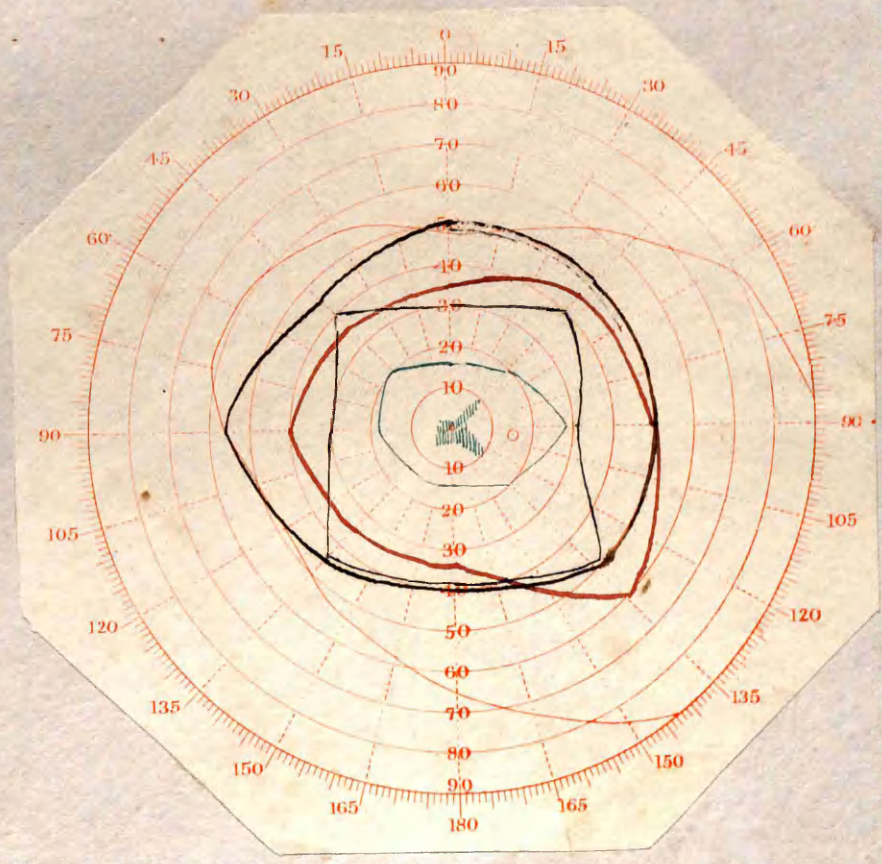
Tobacco Amblyopia.

Case 21. p66



A

Nov. 23: 1887



B

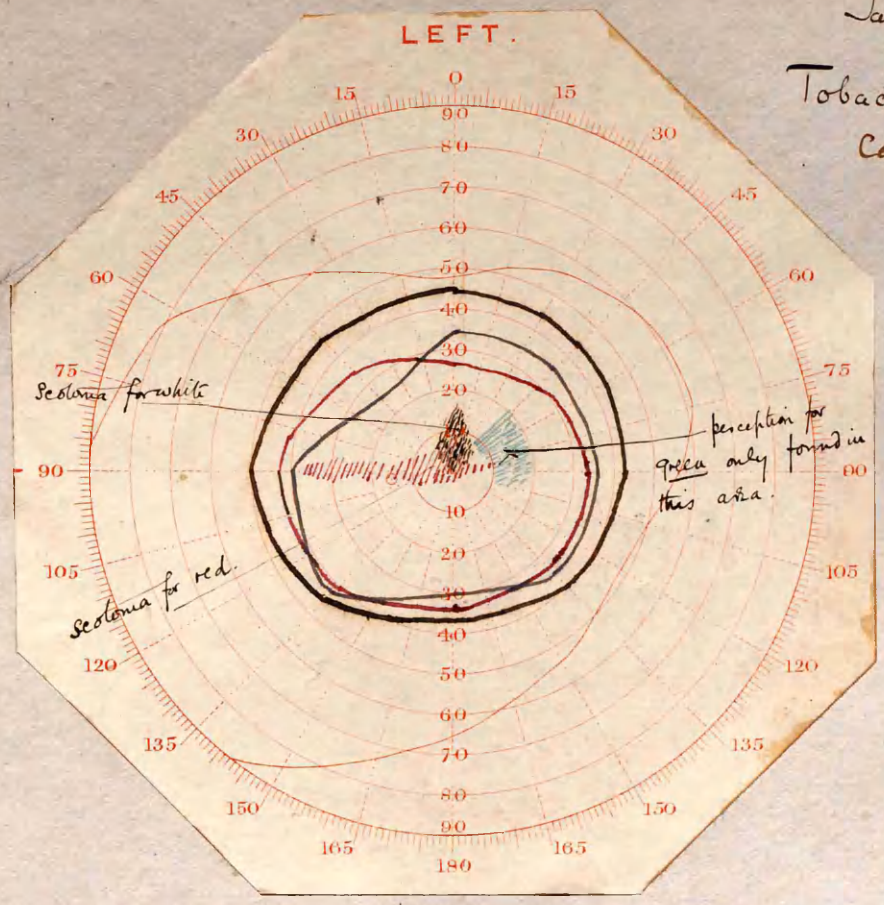
April 11: 1888

Plate XXI.

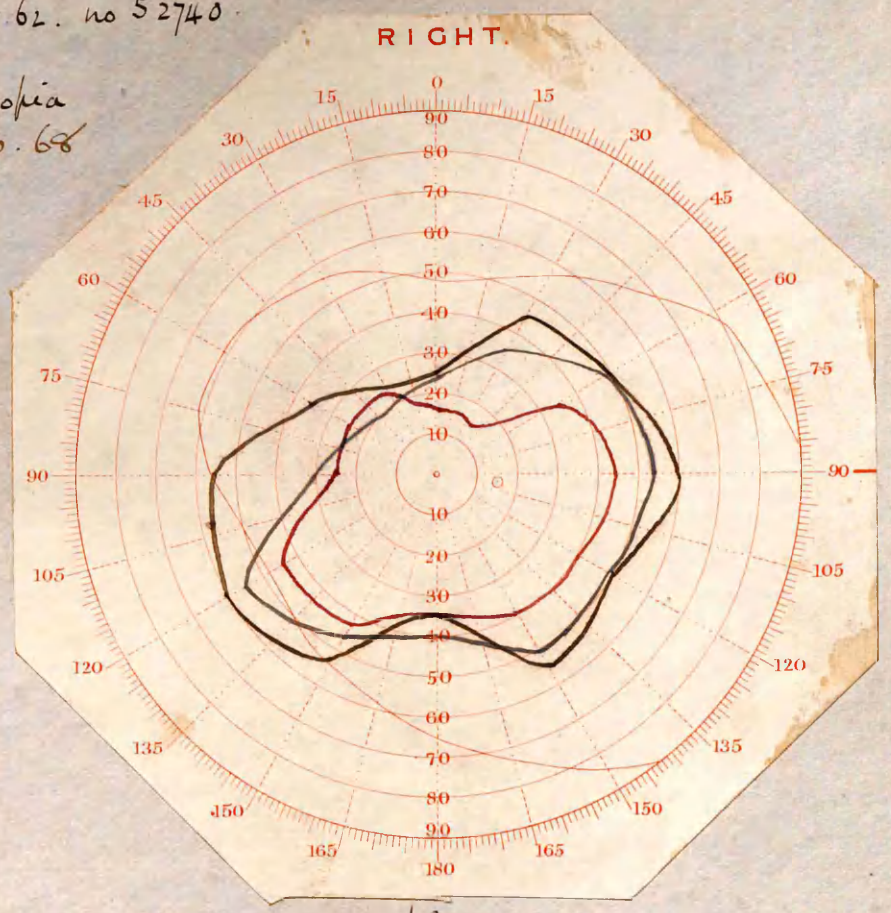
Jas A. aet 62. no 52740.

Tobacco Amblyopia
Case 22 . p. 68

B



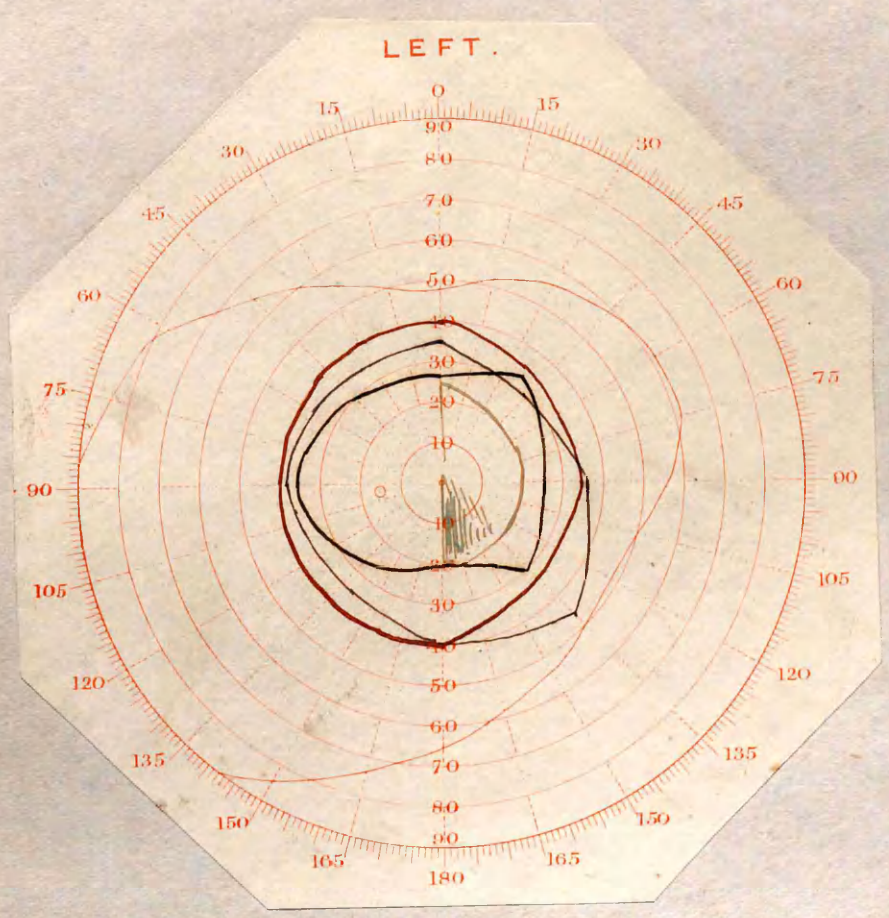
July 20: 1887



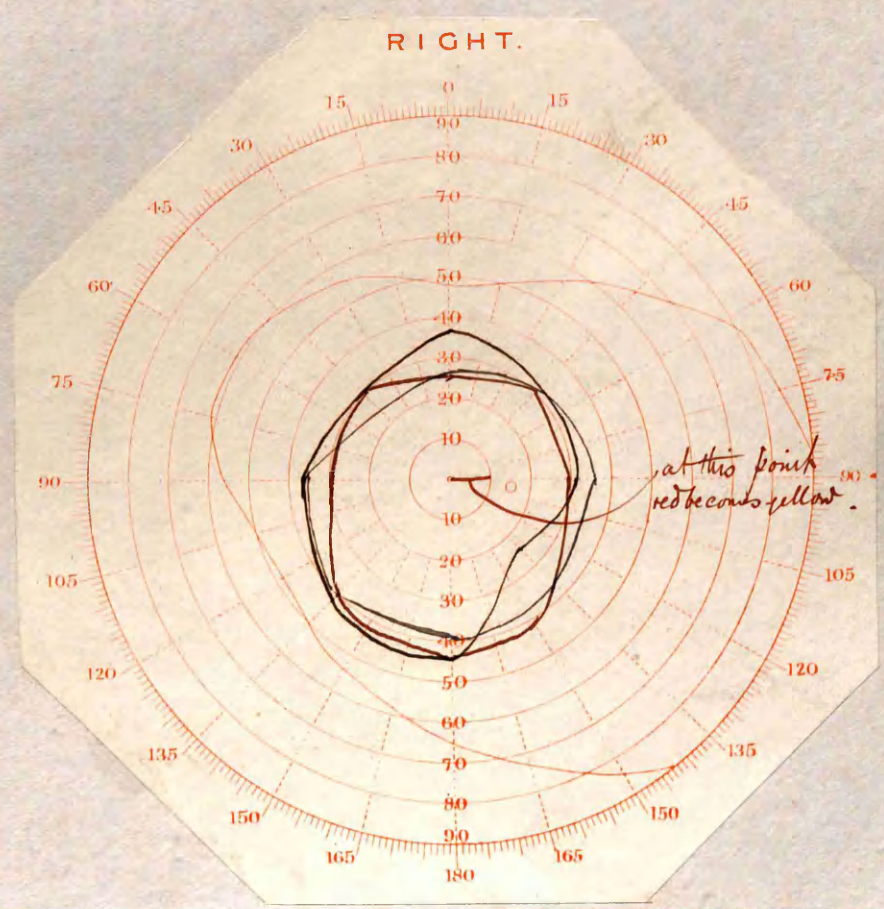
A

July 20: 1887

D



Aug. 31. 1887



C

Aug: 31. 1887

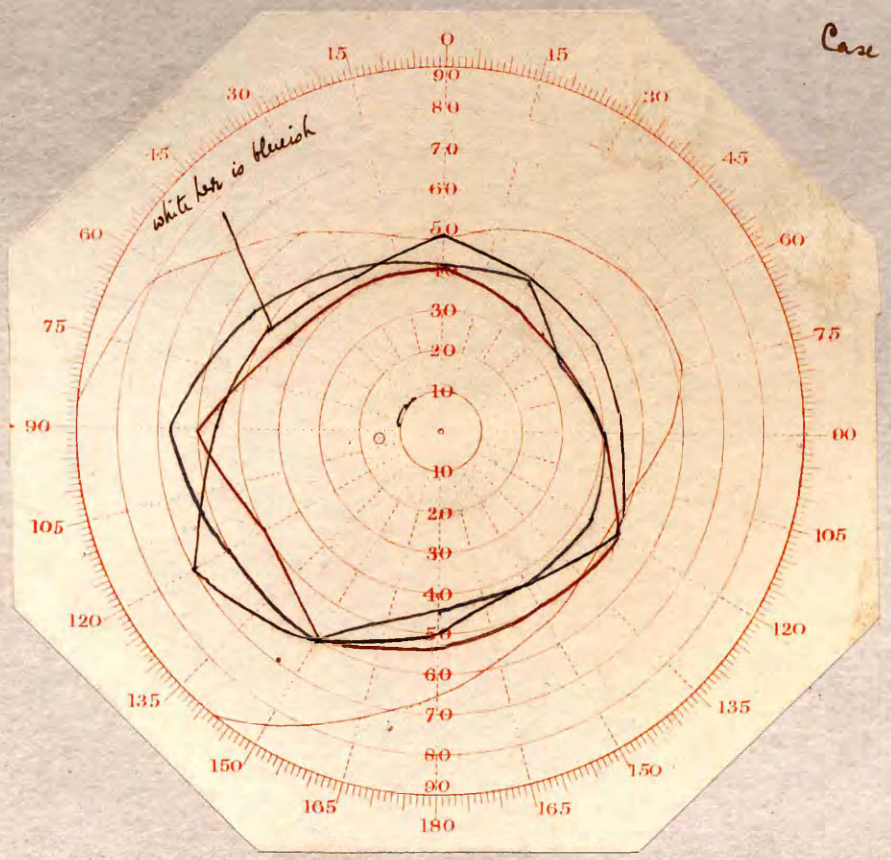
David O. aet 60. nos 2957.

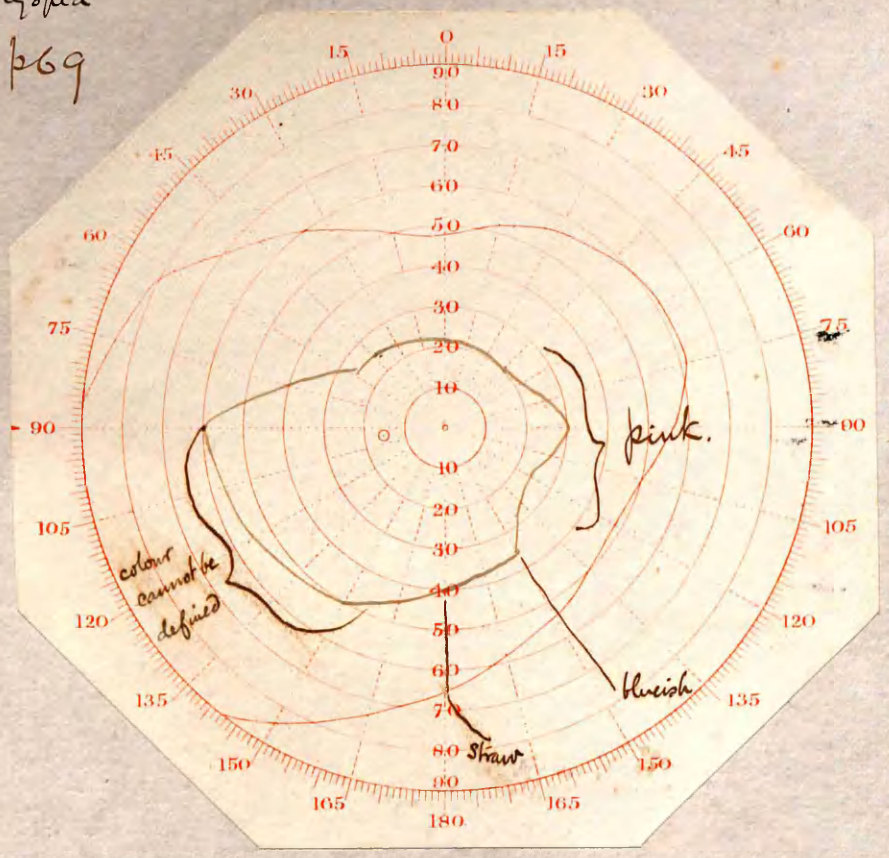
Plate XXII

Tobacco Amblyopia

Case 23. p69

A





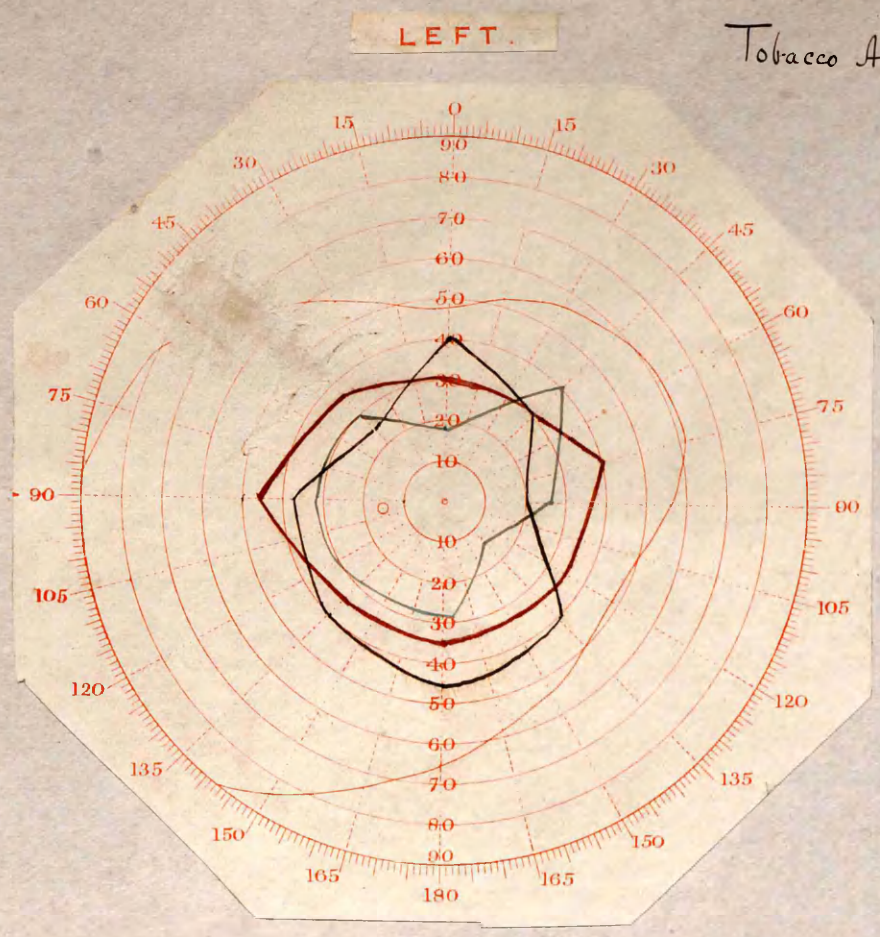
B

David D. aet 28. ho 56058

Plate XXIII

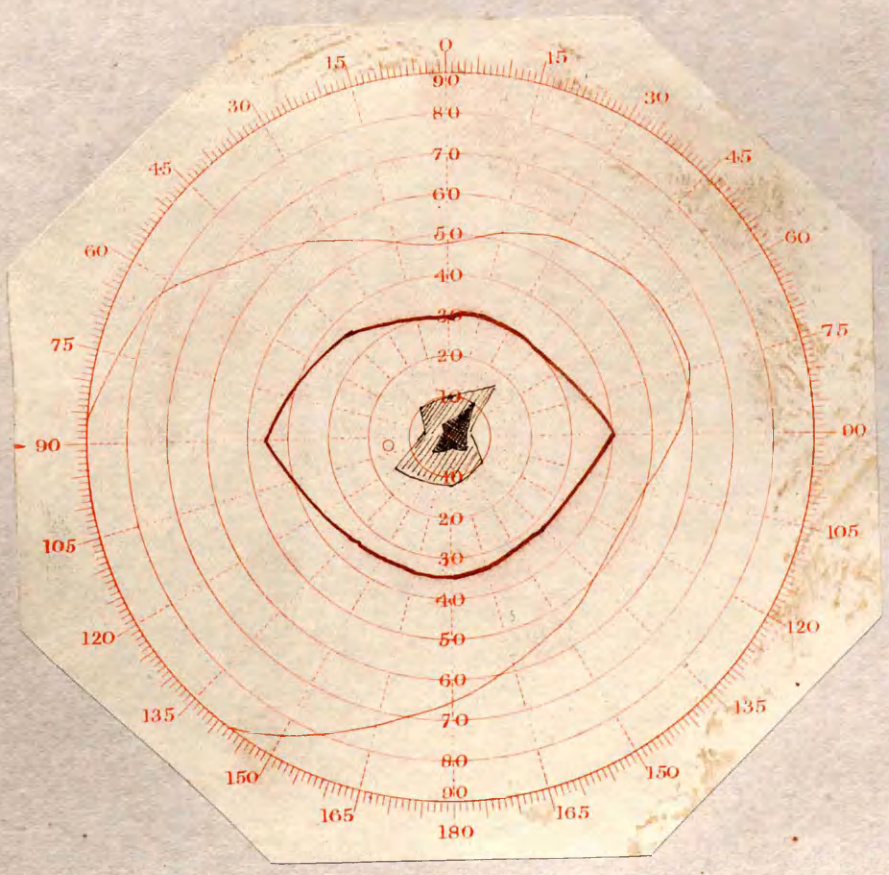
Tobacco Amblyopia.

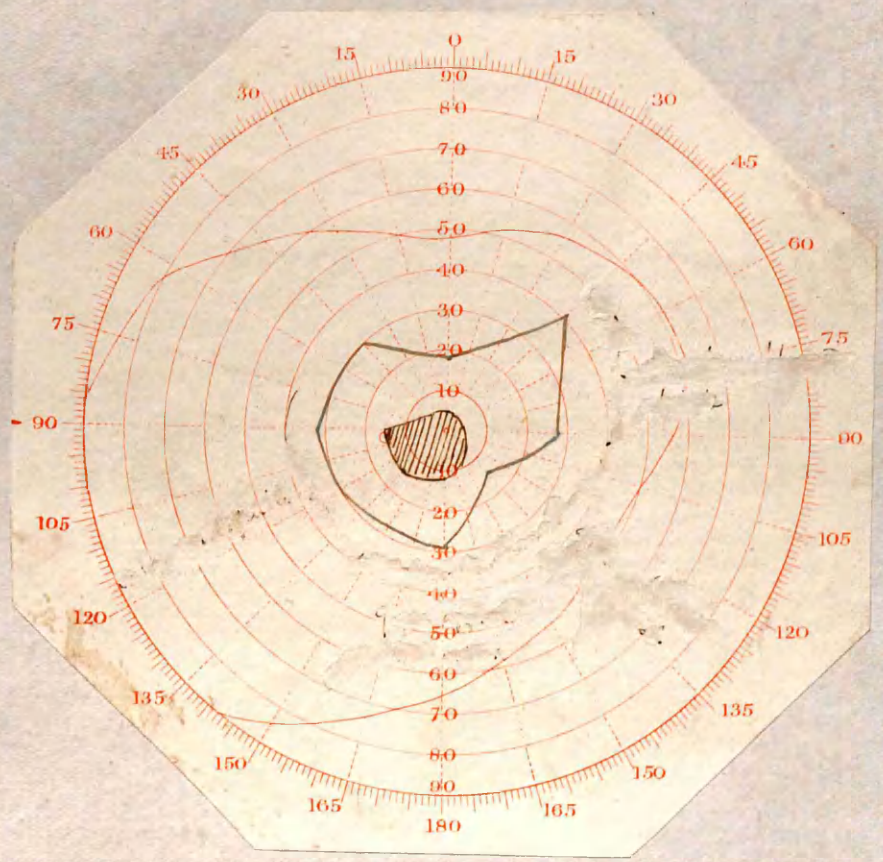
Case 24. p 70



A

B





C

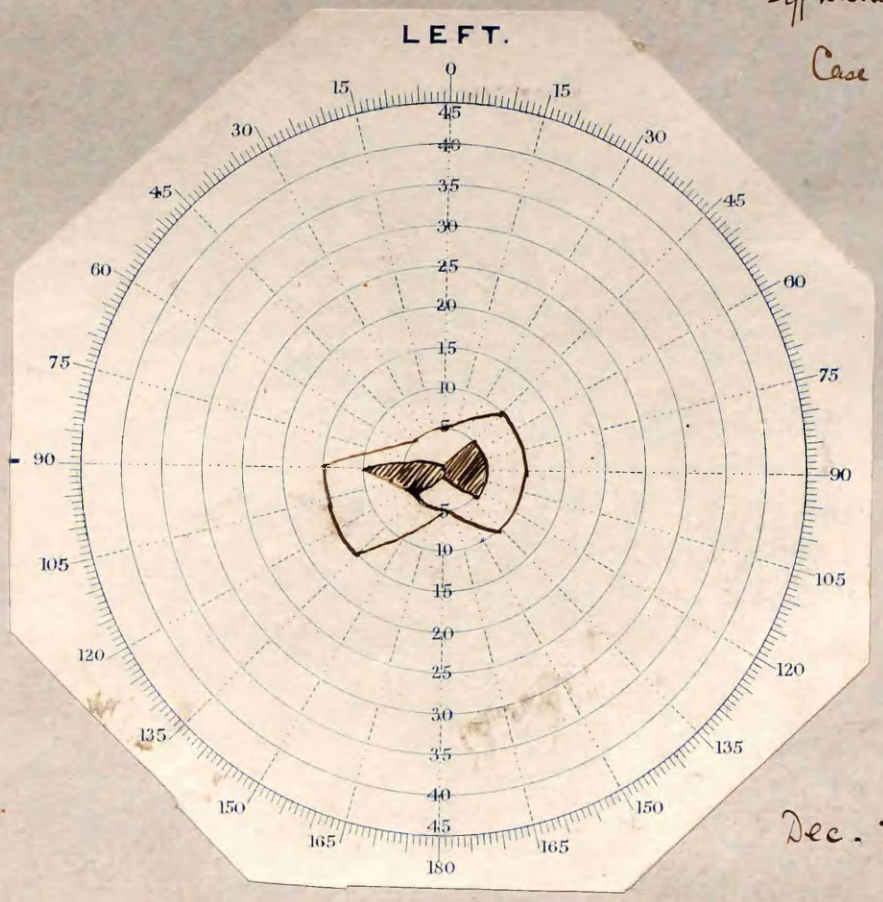
Plate XXIV

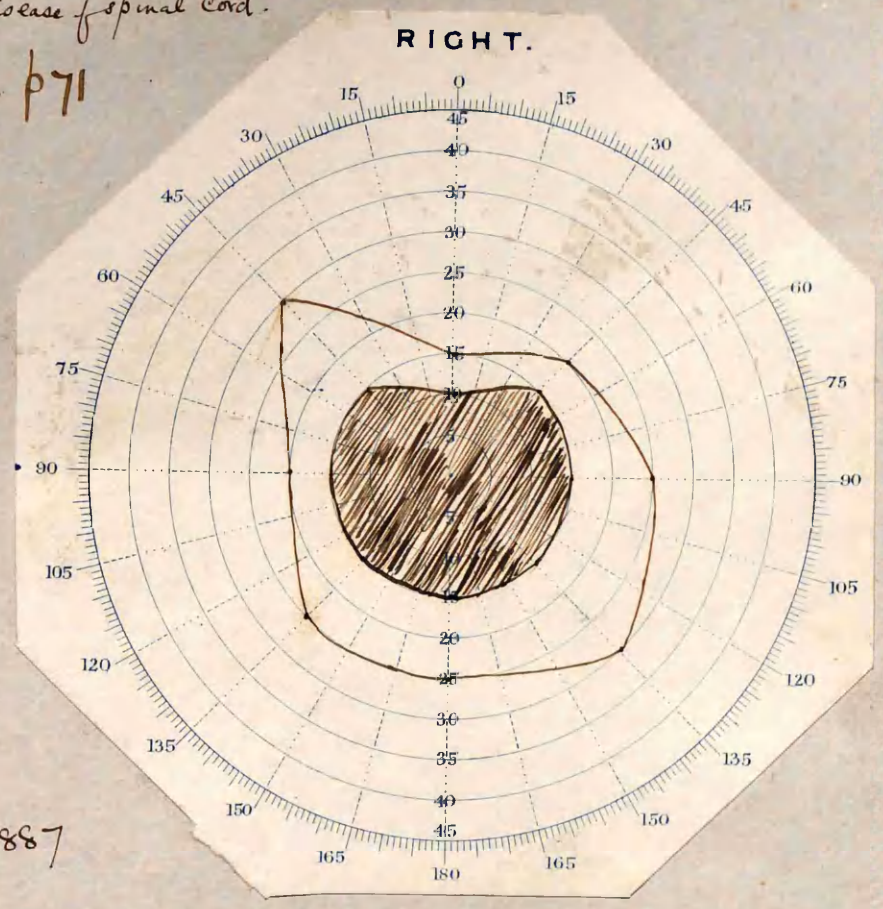
Margt F. aet 39. (Dr. McCall Anderson's case)

Syphilitic disease of spinal cord.

Case 25. p71

B

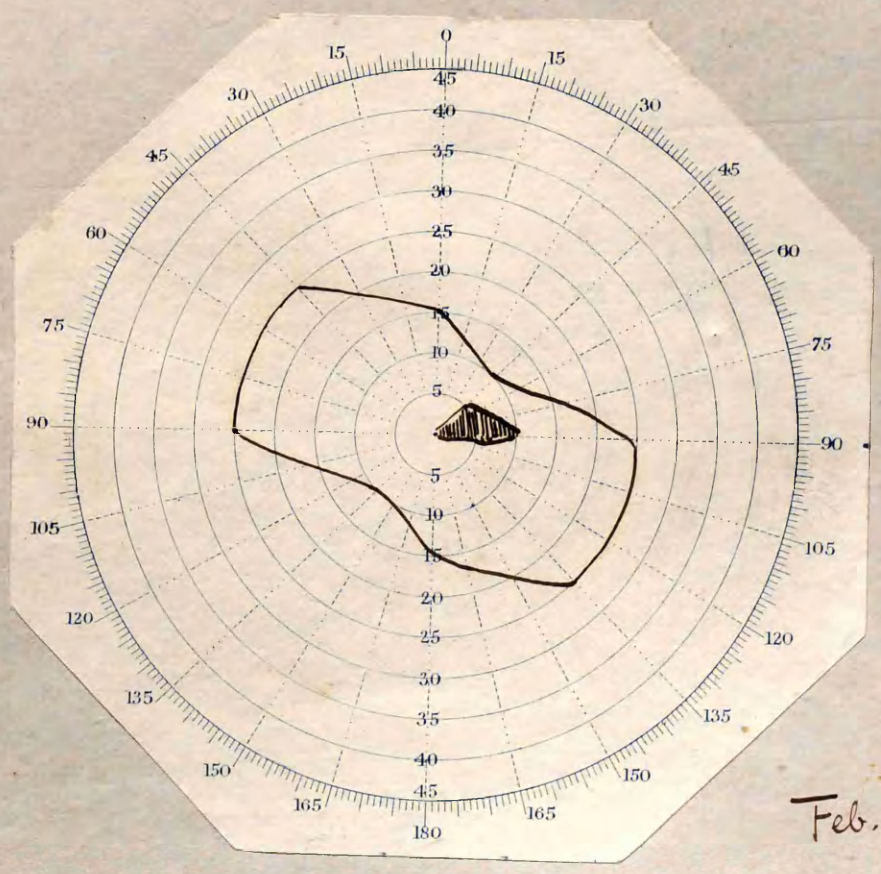




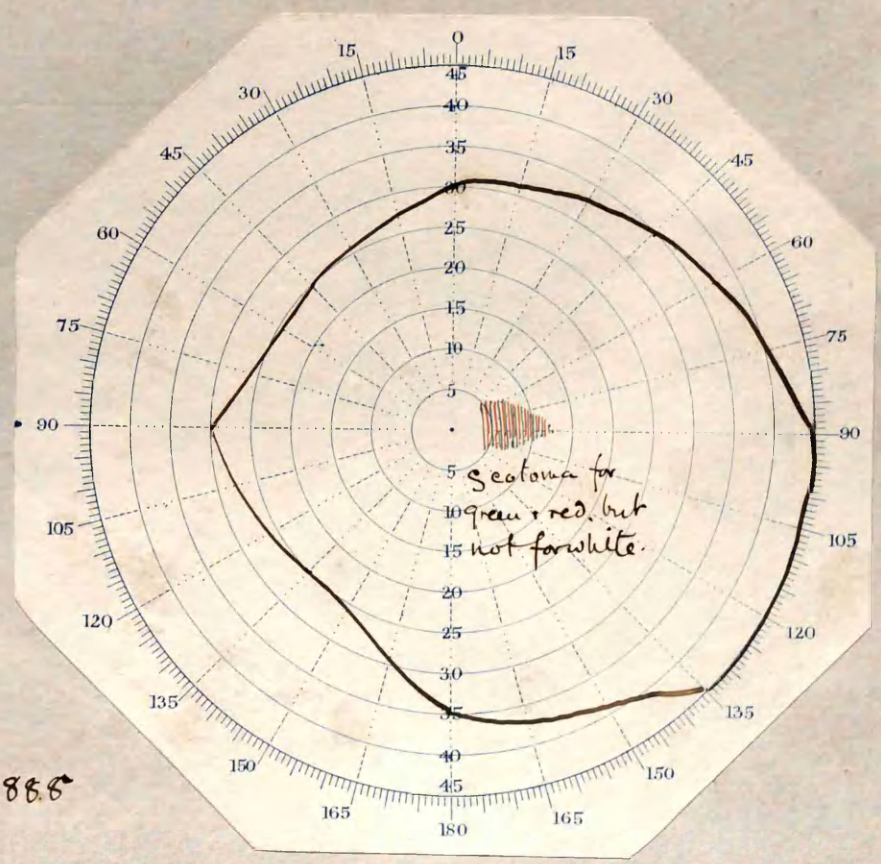
A

Dec. 7. 1887

D



Feb. 5. 1888



C

Plate XXV

Fred: D. æt 35.

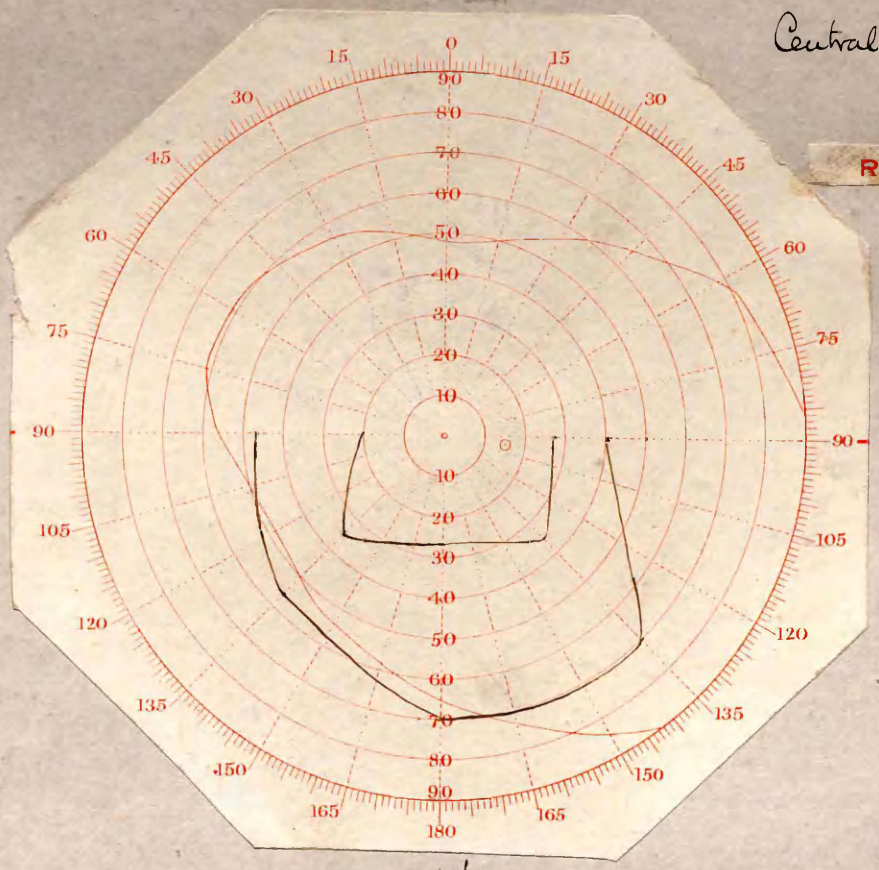
Case 26. p72

no 53619.

Central Scotoma -

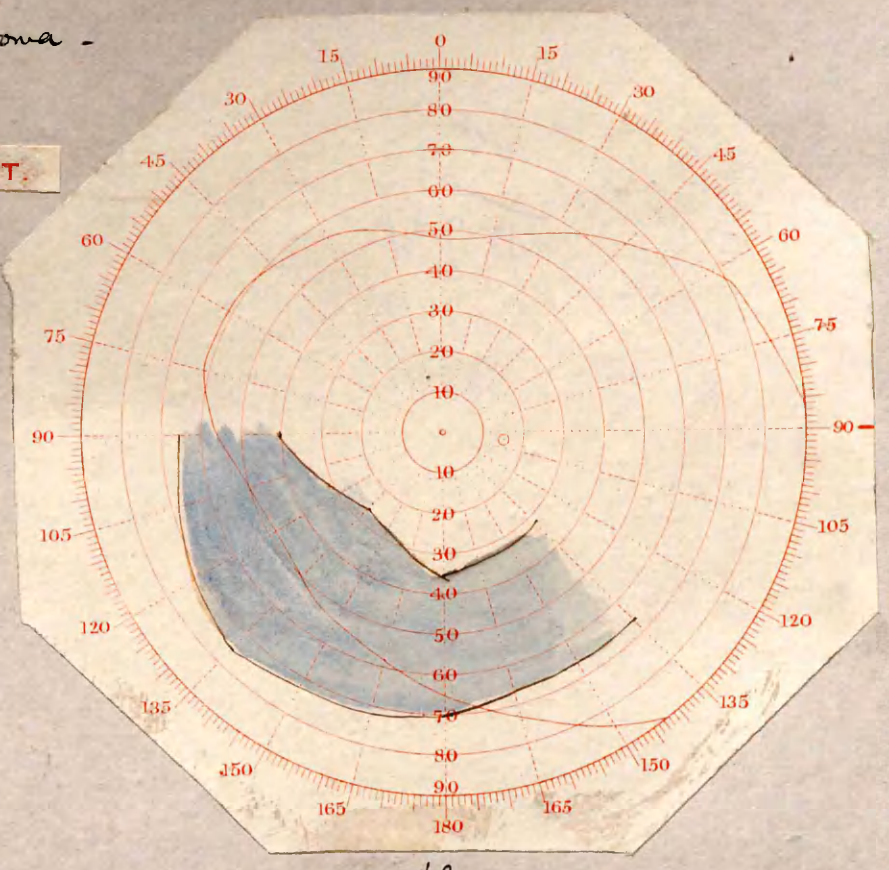
RIGHT.

A



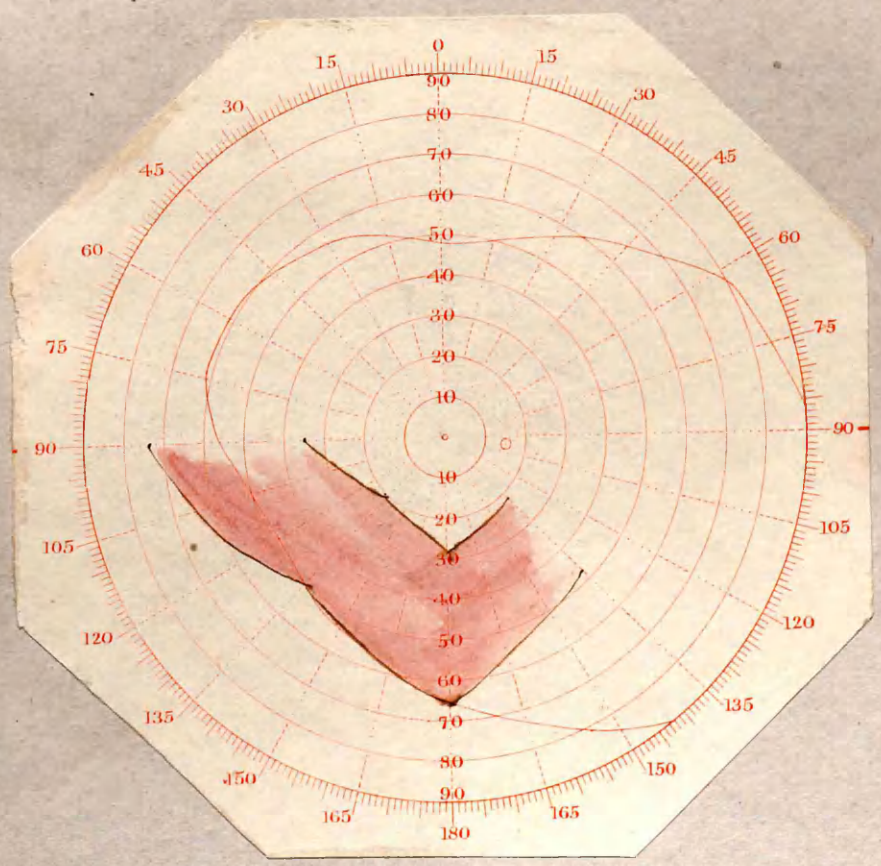
White

B



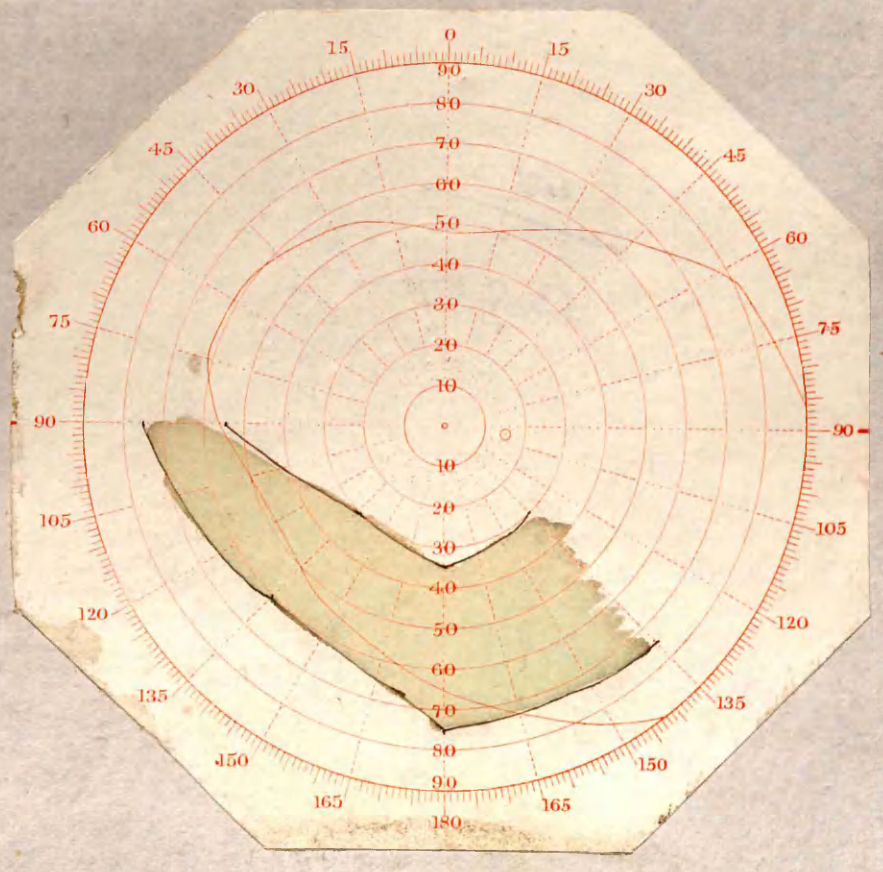
blue

C



Red

D



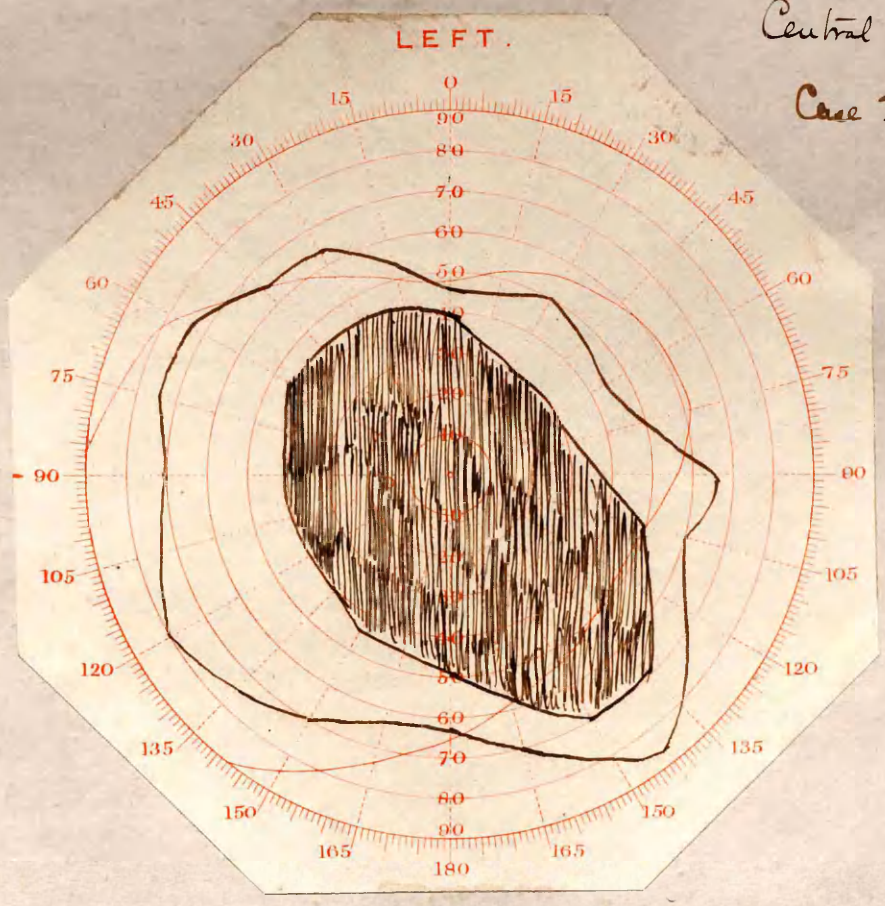
Green

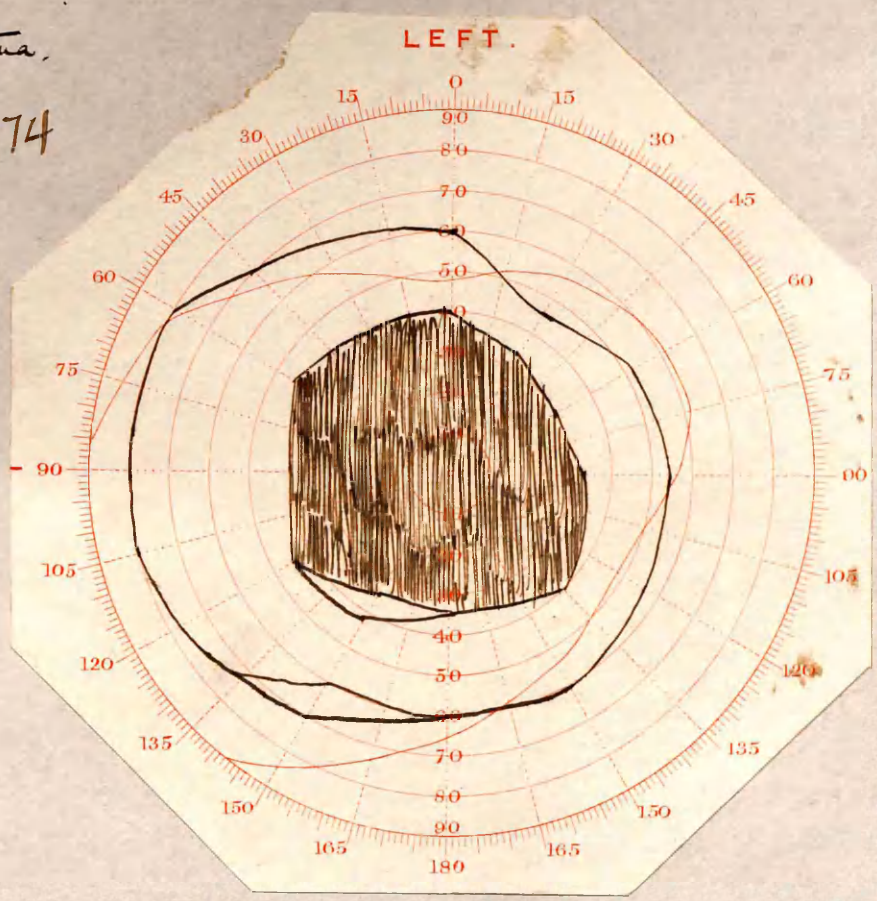
Plate XXVI

Margt B. aet 16. no 49328

Central Scotoma.

Case 27. p 74



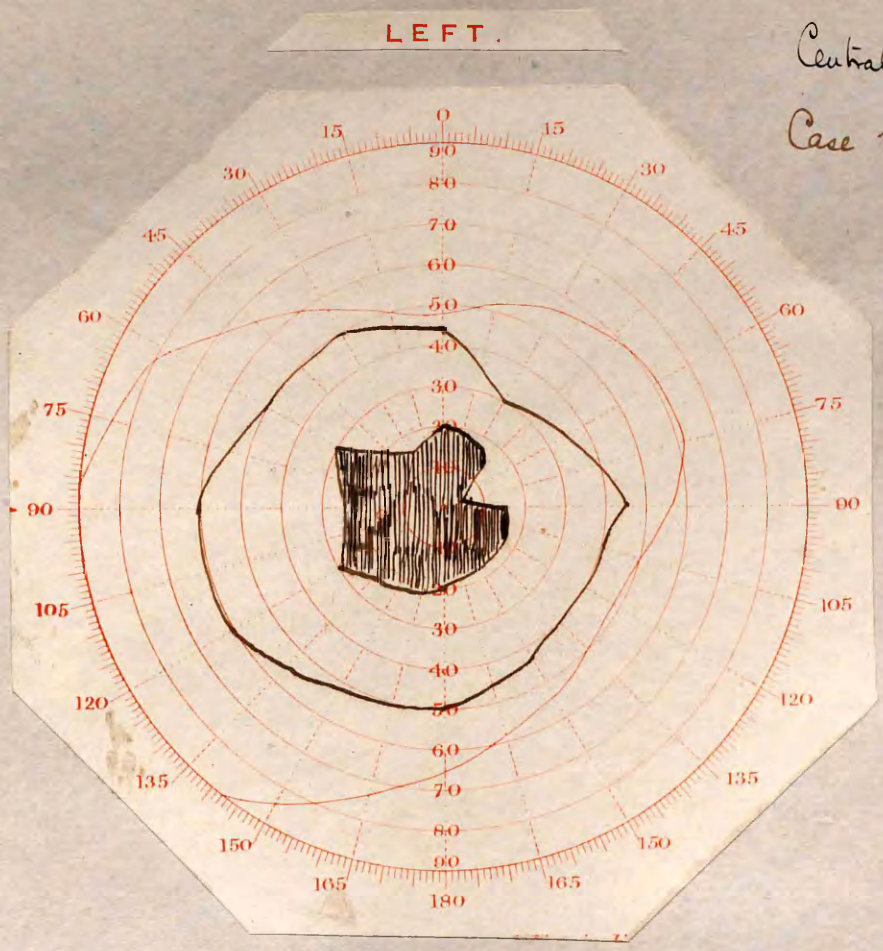


Samuel McM. aet 24. no49252

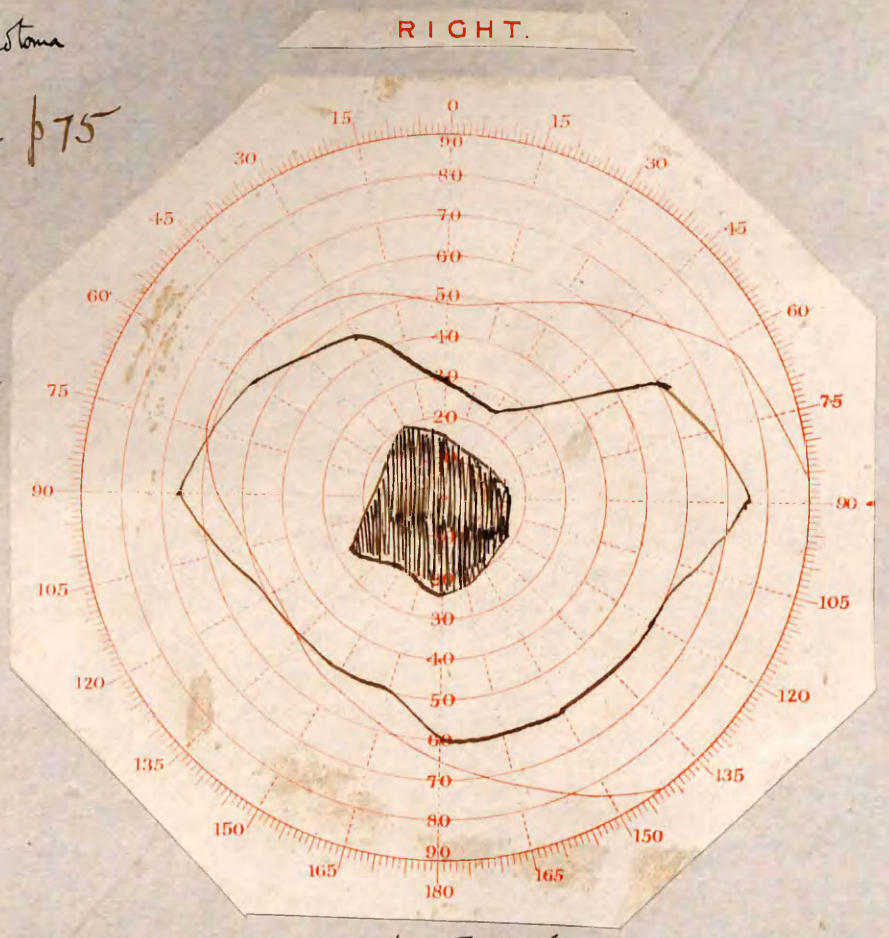
Plate XXVII

Central Scotoma

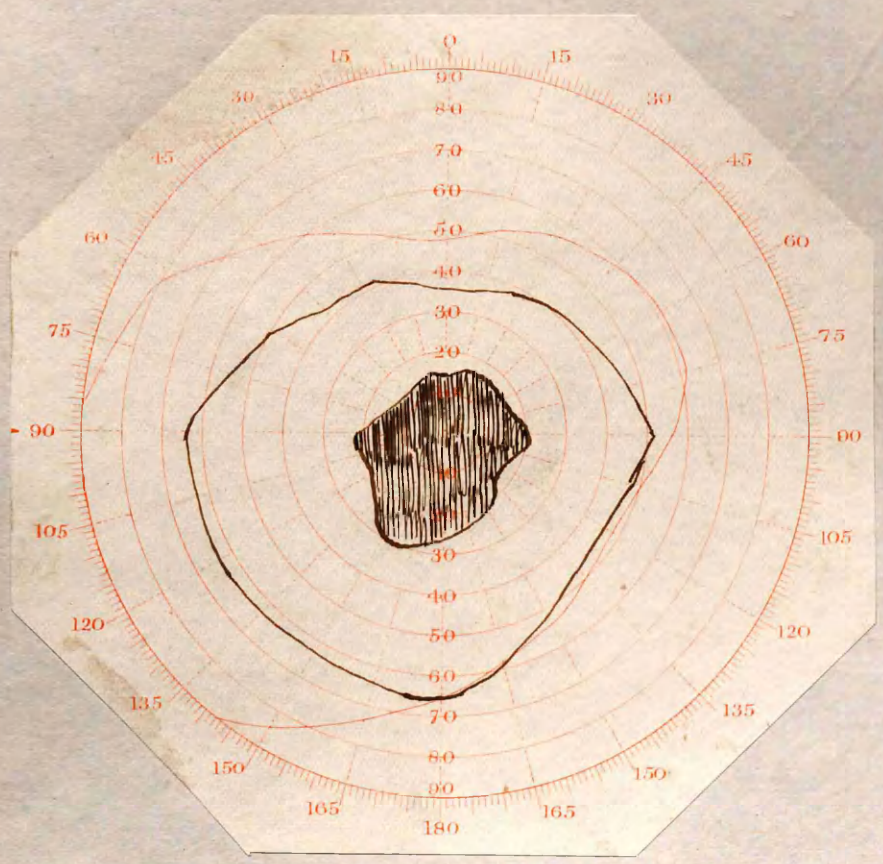
Case 28. p75



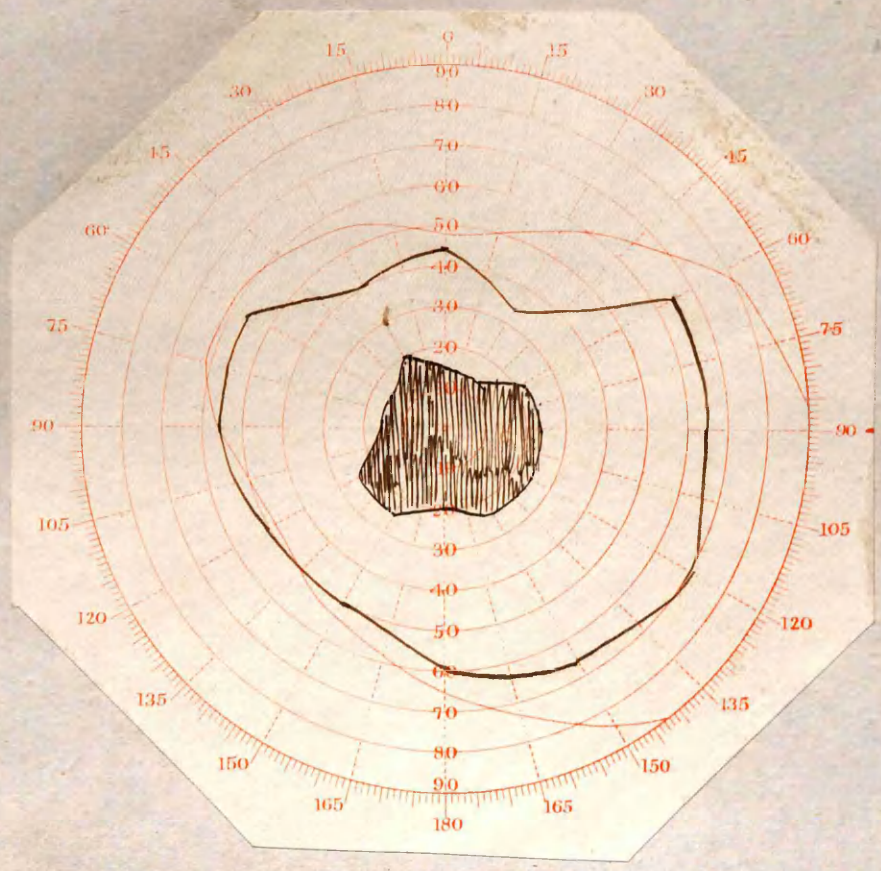
Nov. 15 : 1886



Nov. 15. 1886.



Dec 4 : 1886



Dec 4. 1886.

Jas B. aet 47. no 48890.

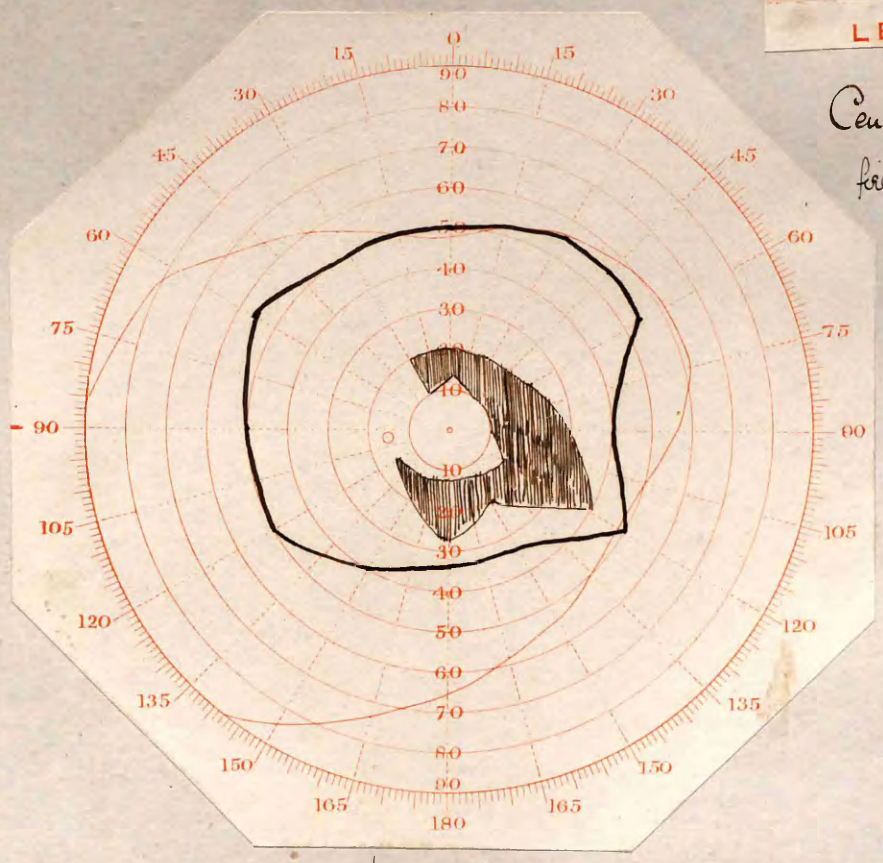
Plate XXVIII

Case 29. p 76.

LEFT.

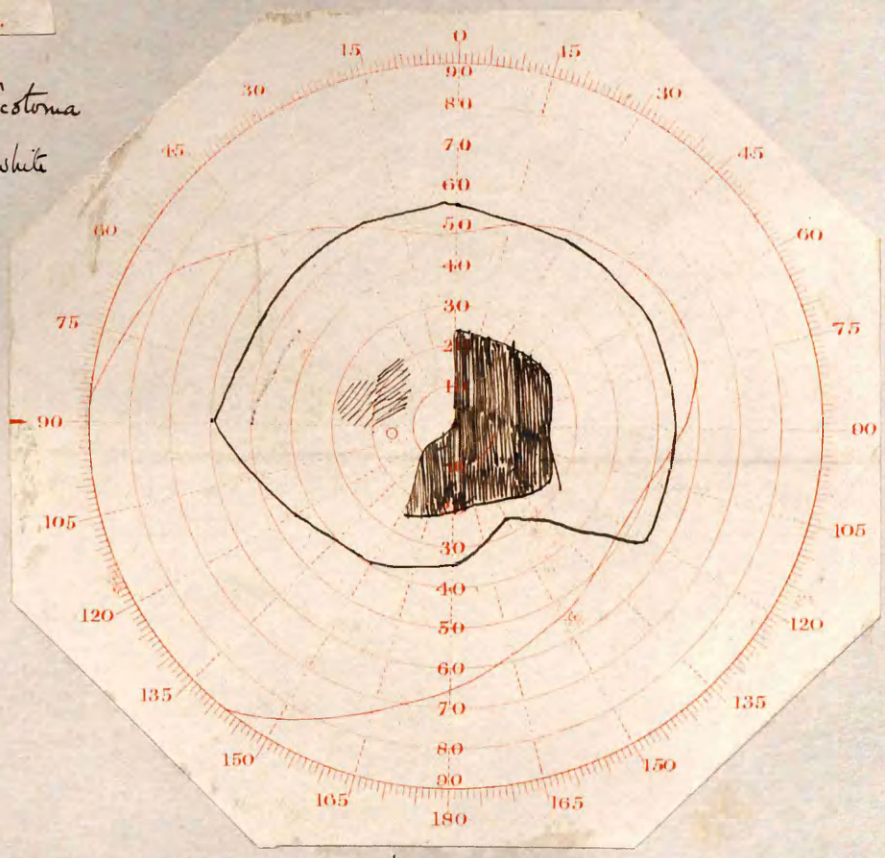
Central Scotoma
fixed for white

A



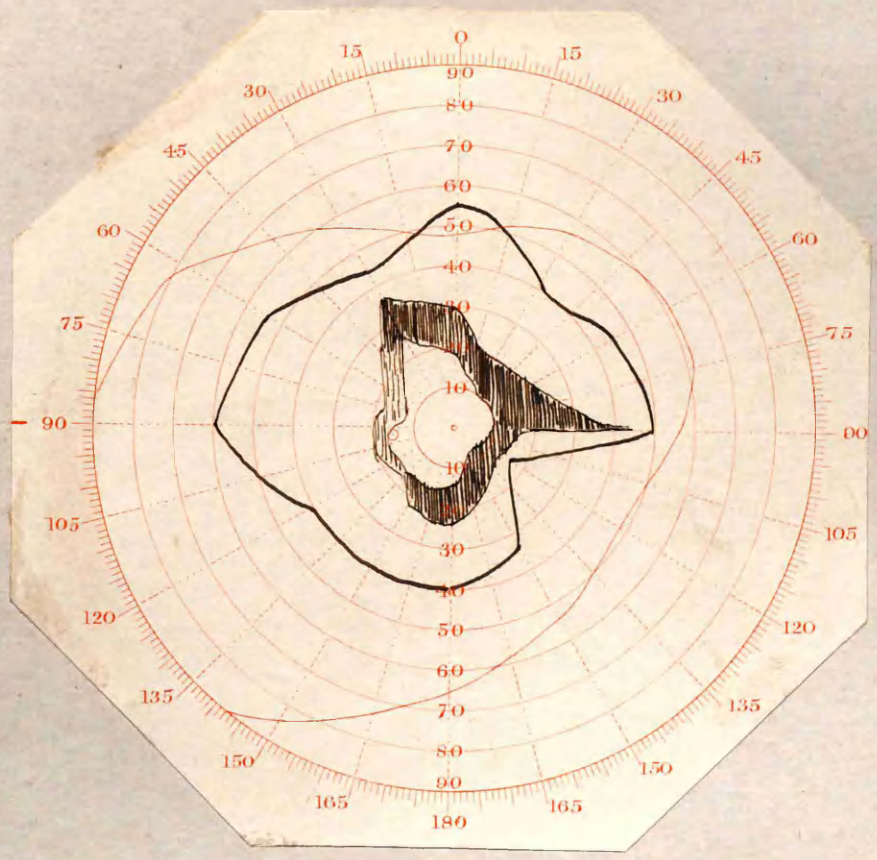
June 8. 1887

B



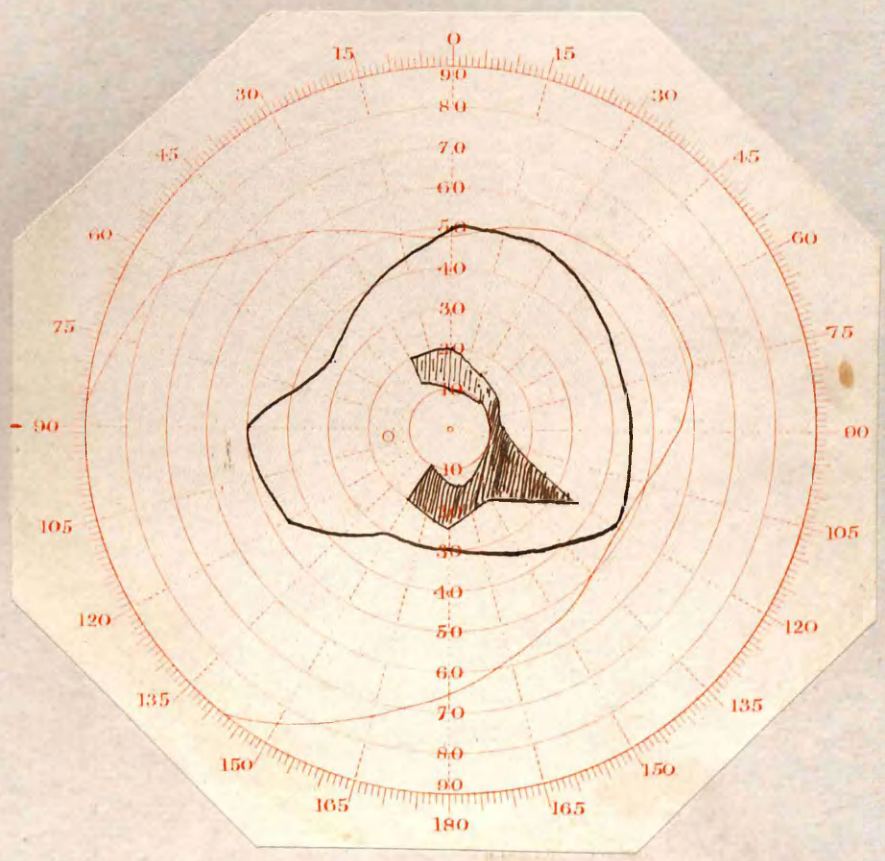
June 22: 1887

C



May 3. 1889

D



May 31. 1887.

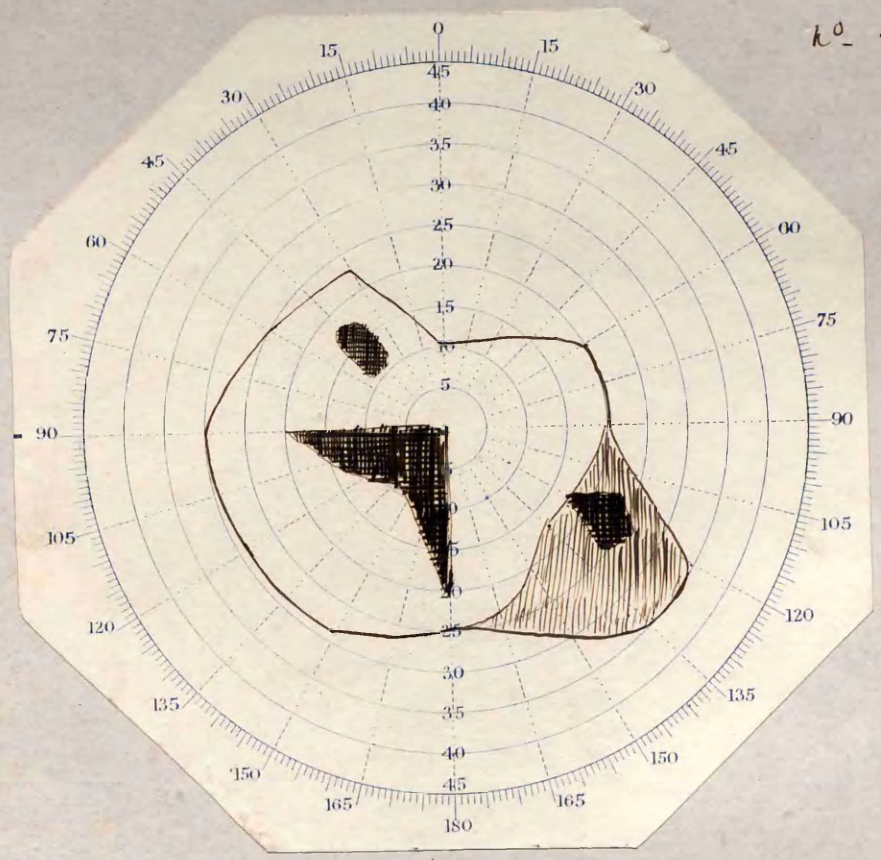
Plate XXIX

RIGHT.

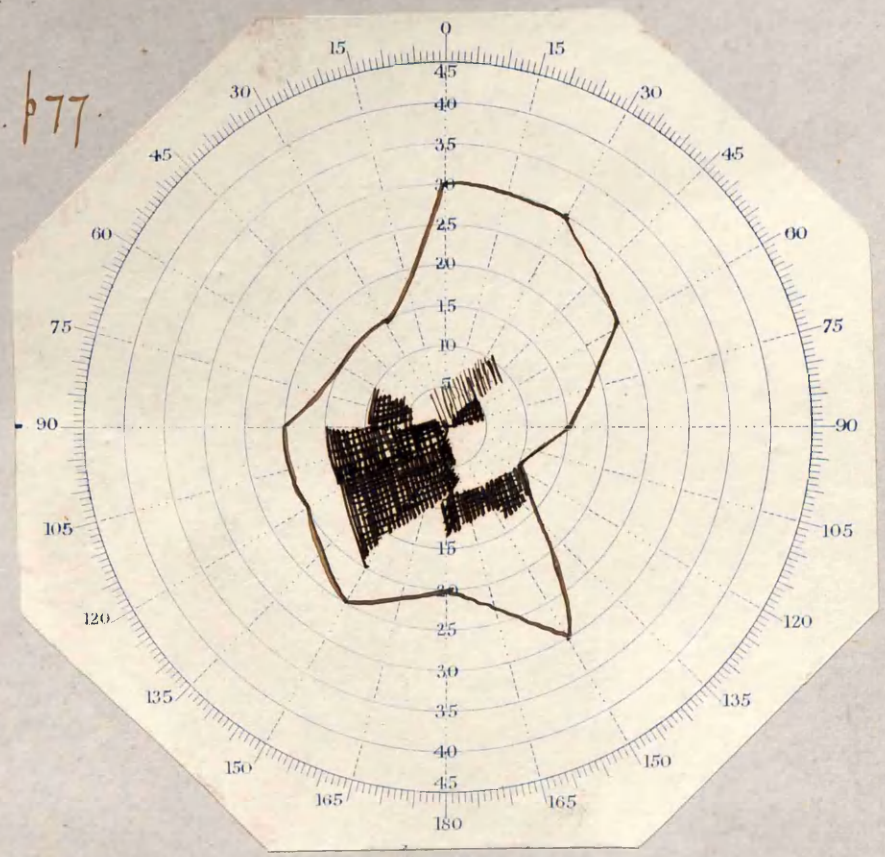
Wm A. aet

No 53013

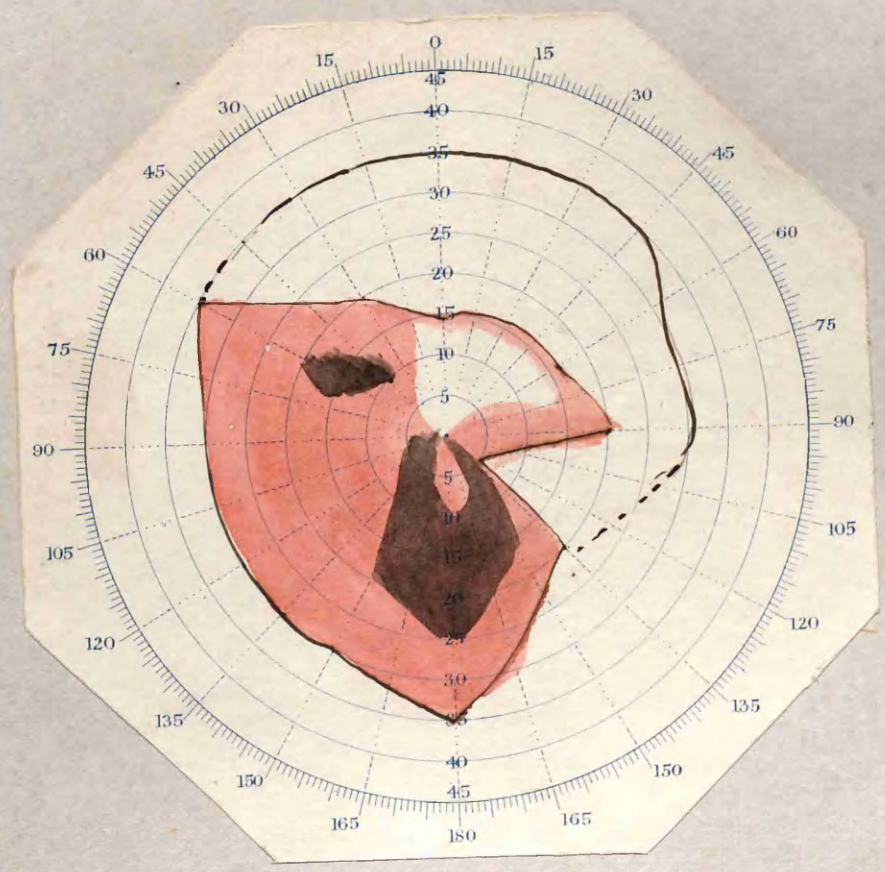
Case 30. p77.



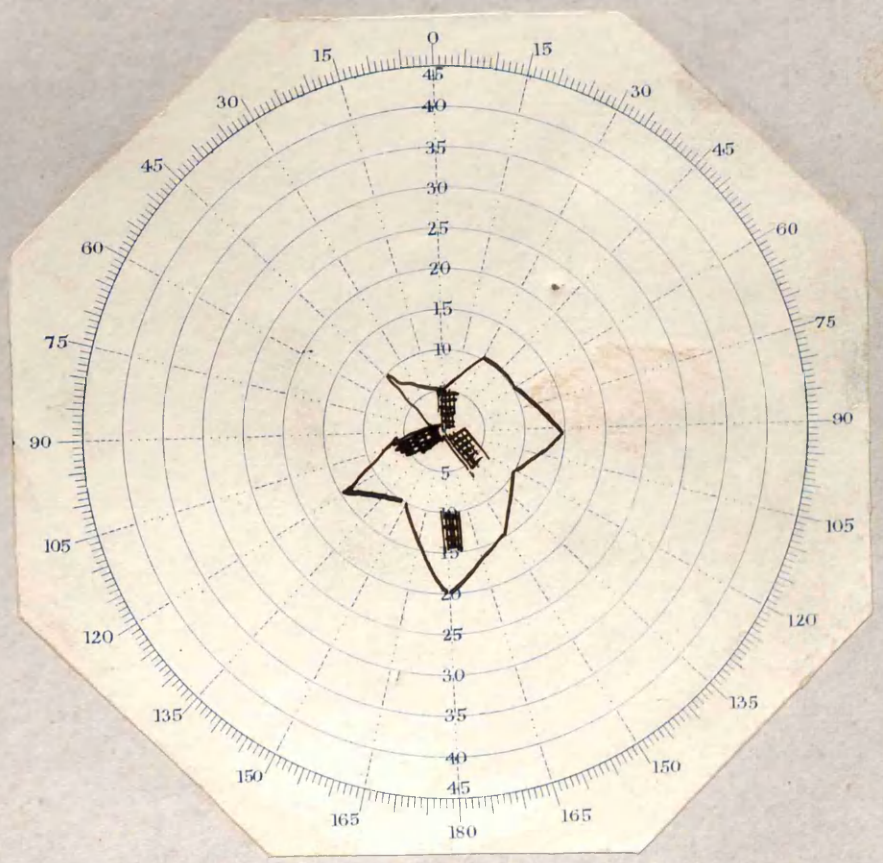
White



Blue.



Red



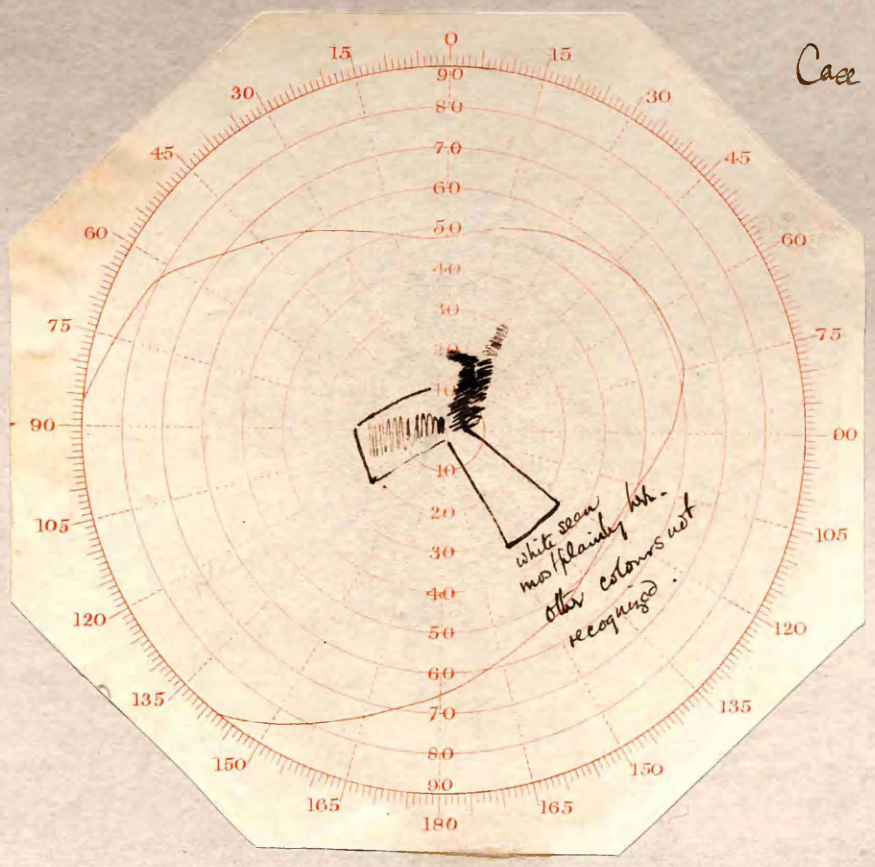
Green

Plate XXX

John McG. aet 26. no 52817

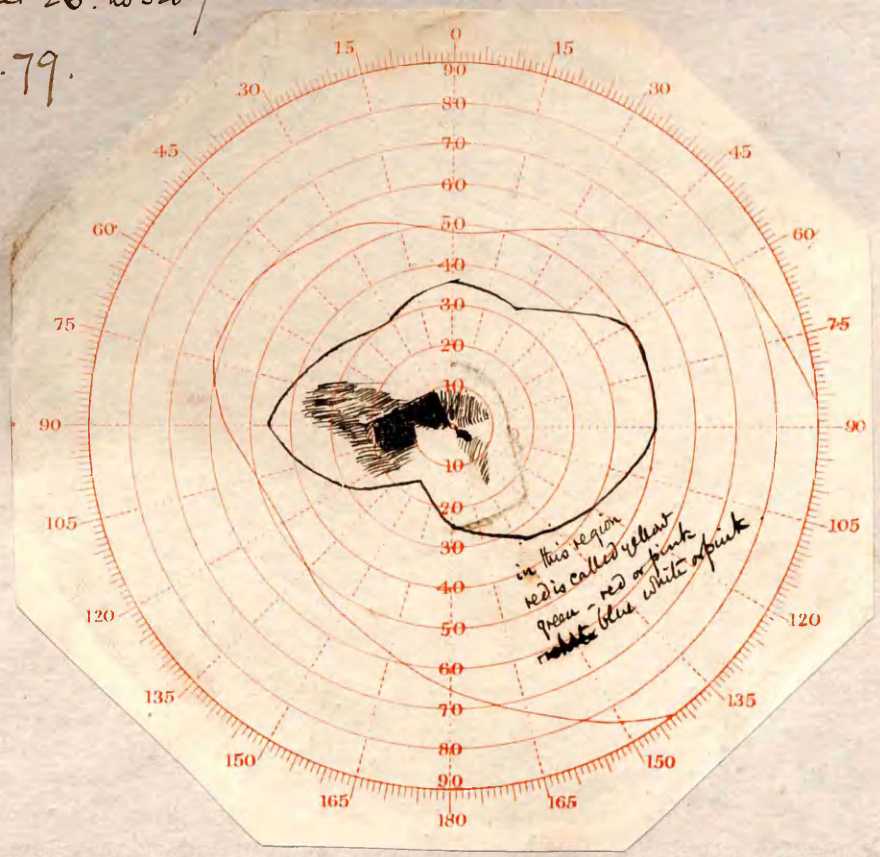
Case 31 p. 79.

LEFT.



B

RIGHT.



A

Plate XXXI

LEFT.

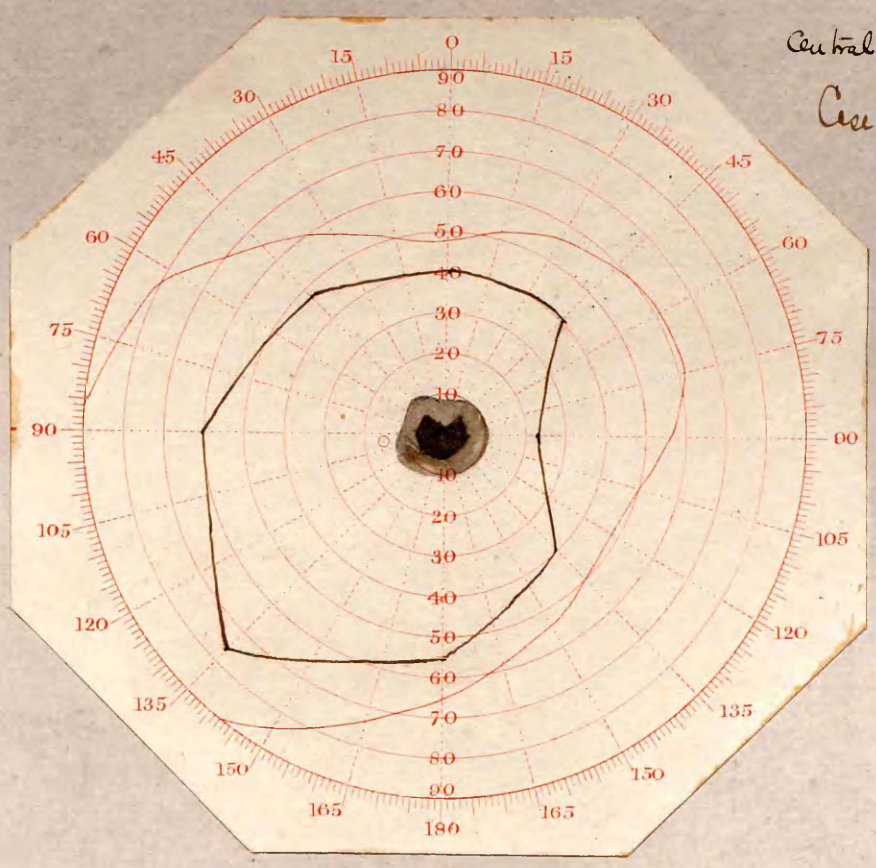
Jas McA. aet. 55 ho

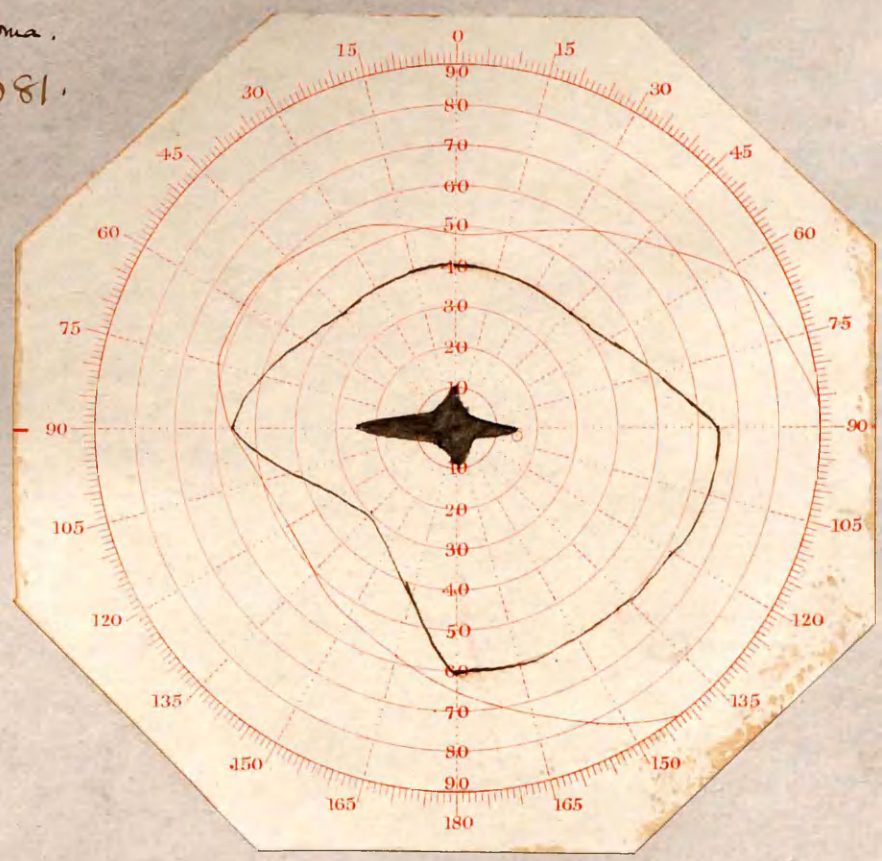
Central Scotoma.

Cer 32. p81.

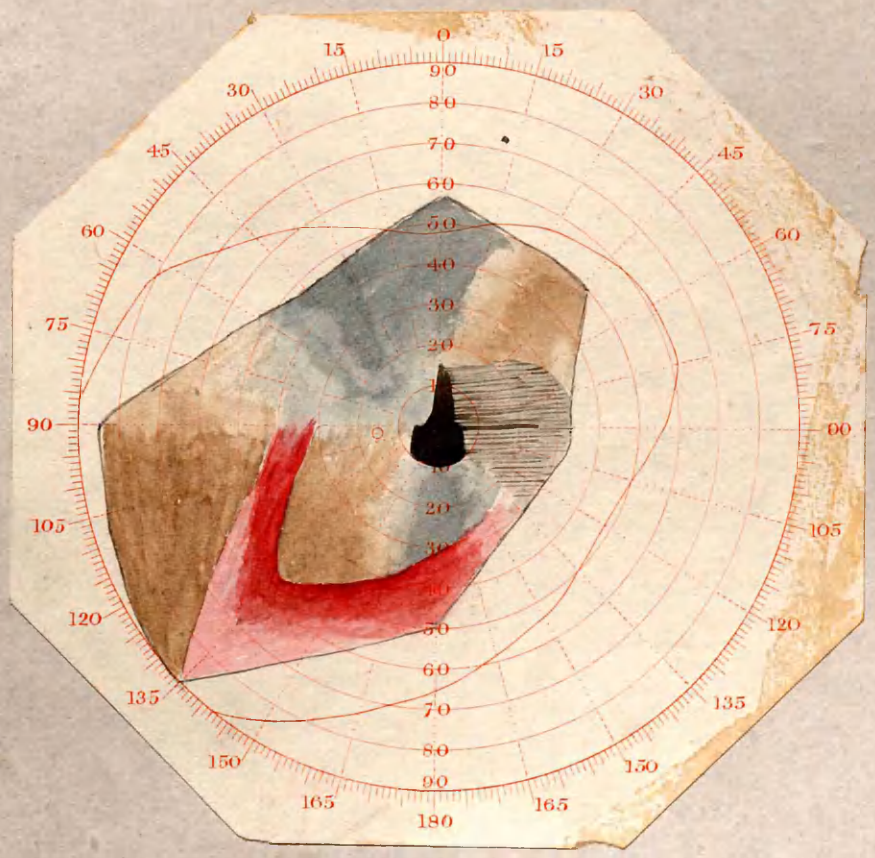
RIGHT.

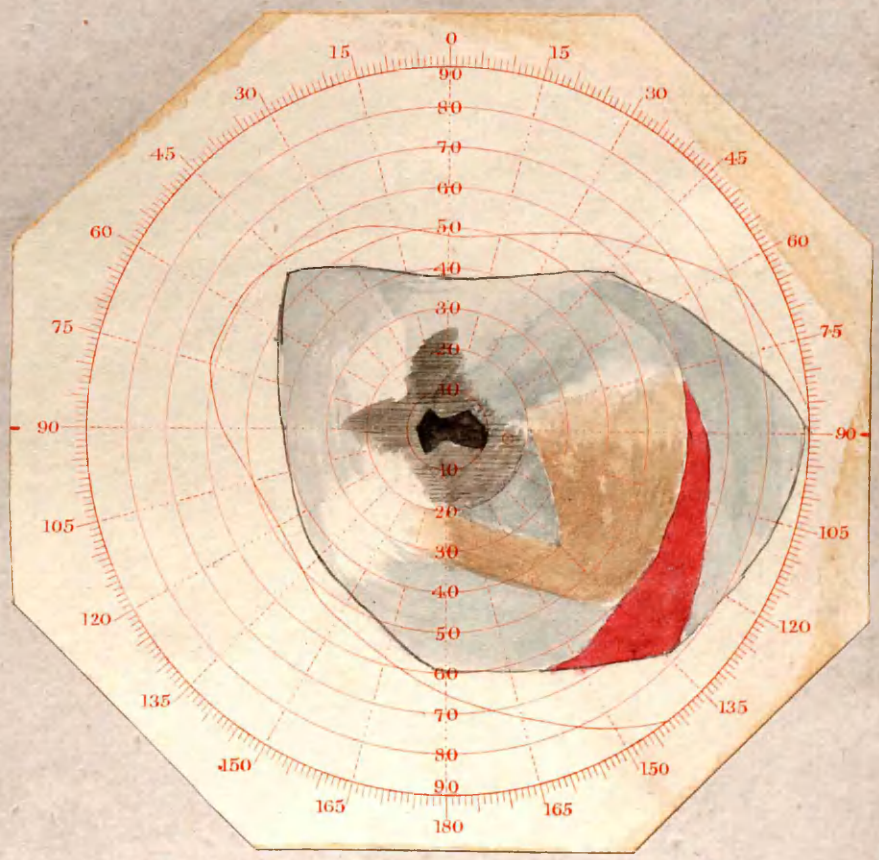
C





A





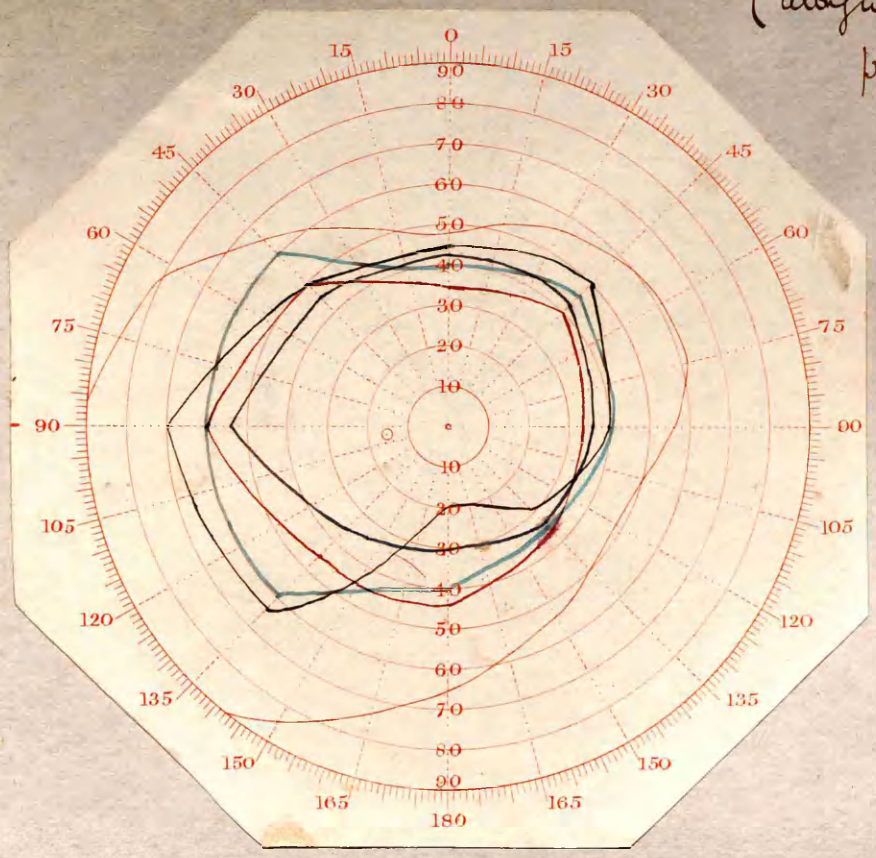
B

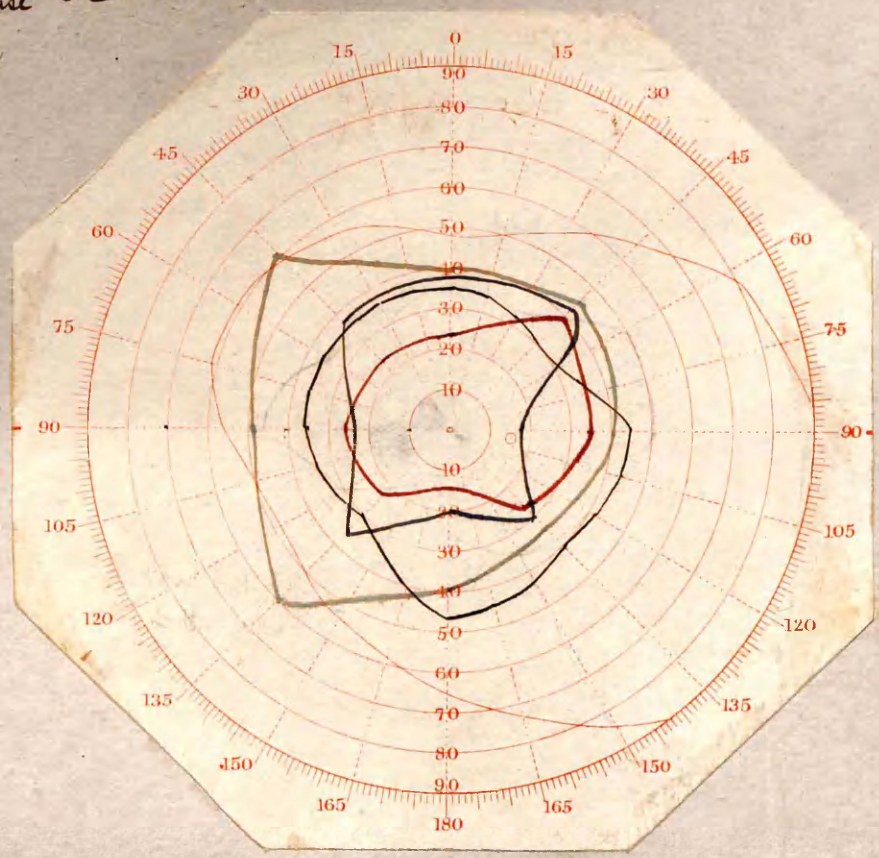
- Mr A. no 5277.

(along with case 32.

p824

Plate XXXII



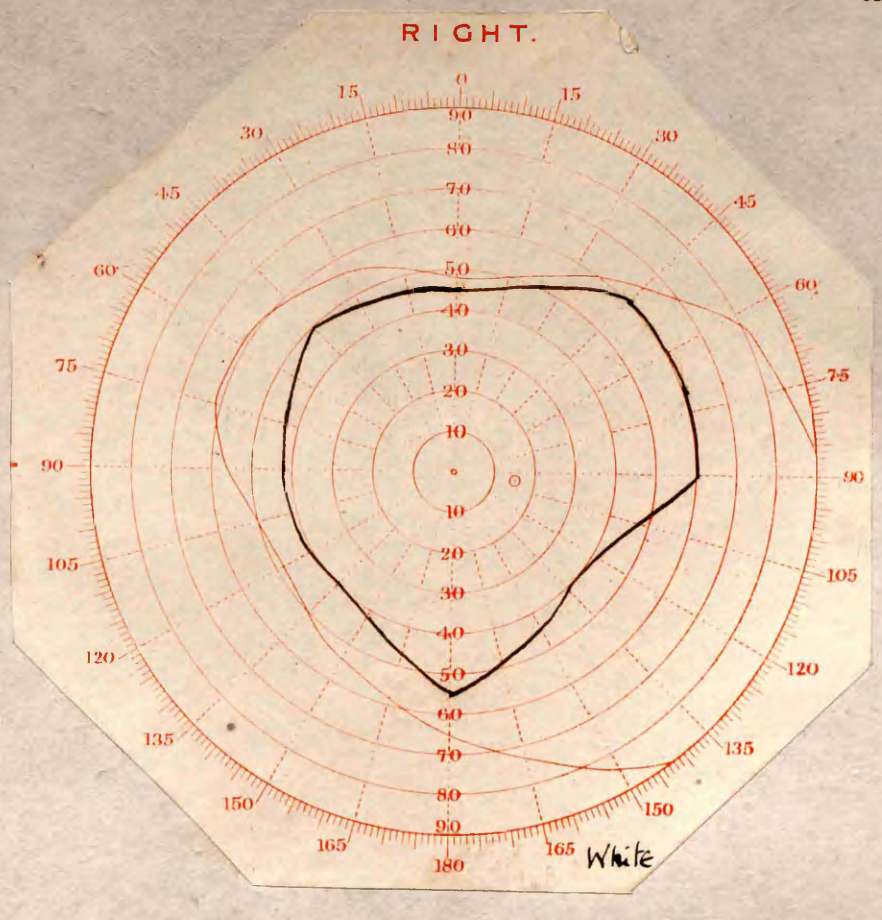


Maxwell C. aet 66. no 55420

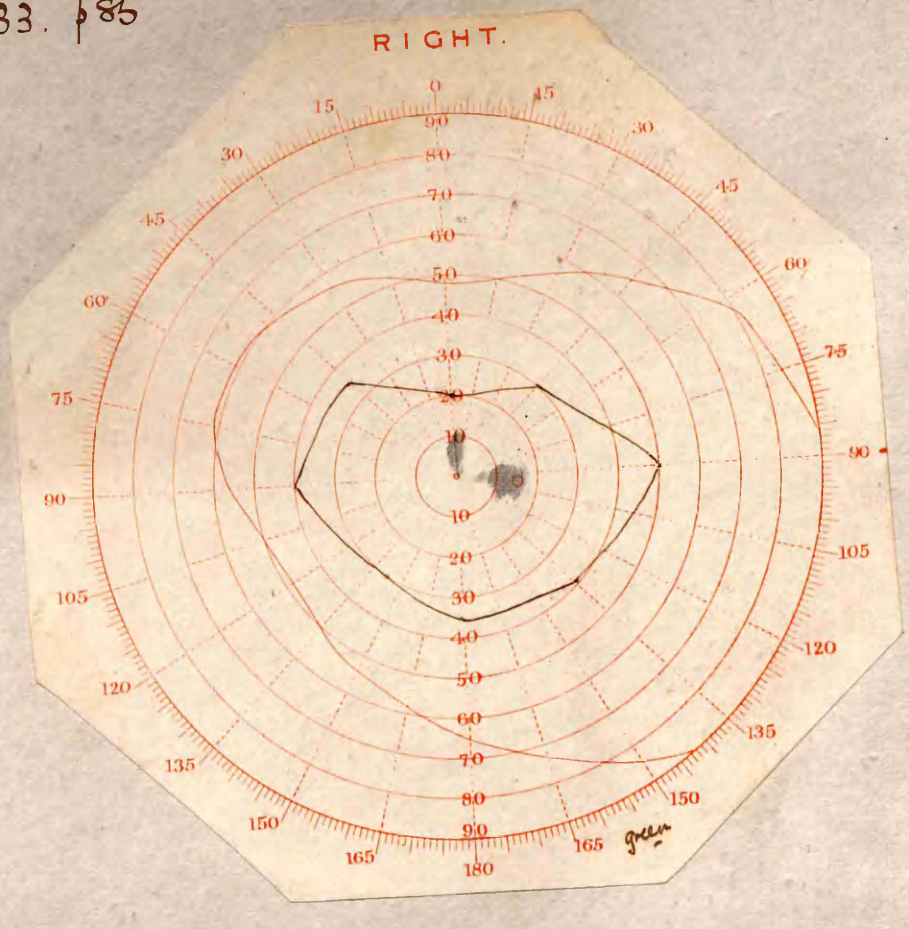
Case 33. f85

Plate XXXIII.

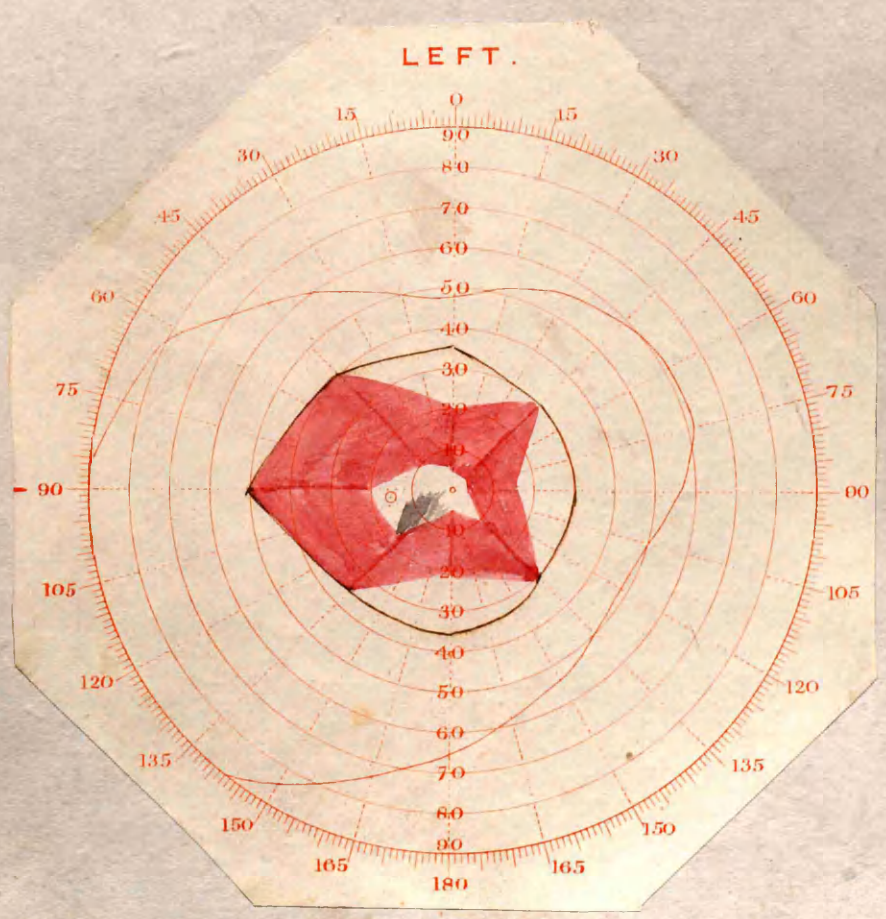
A



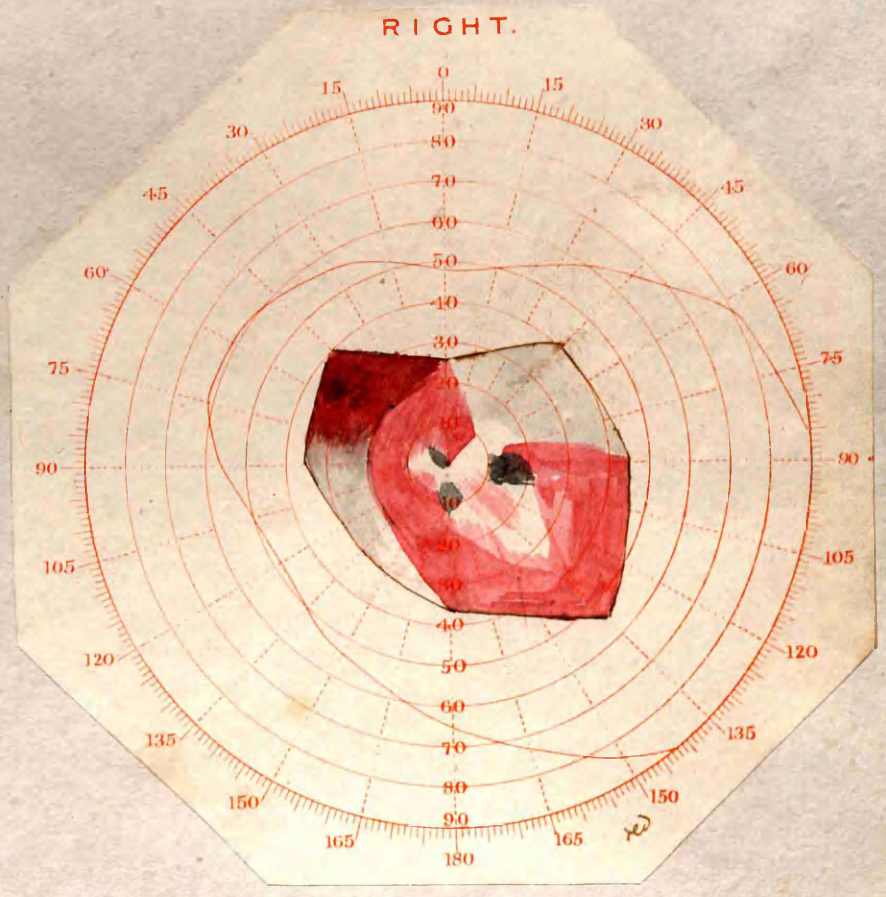
B



A



C



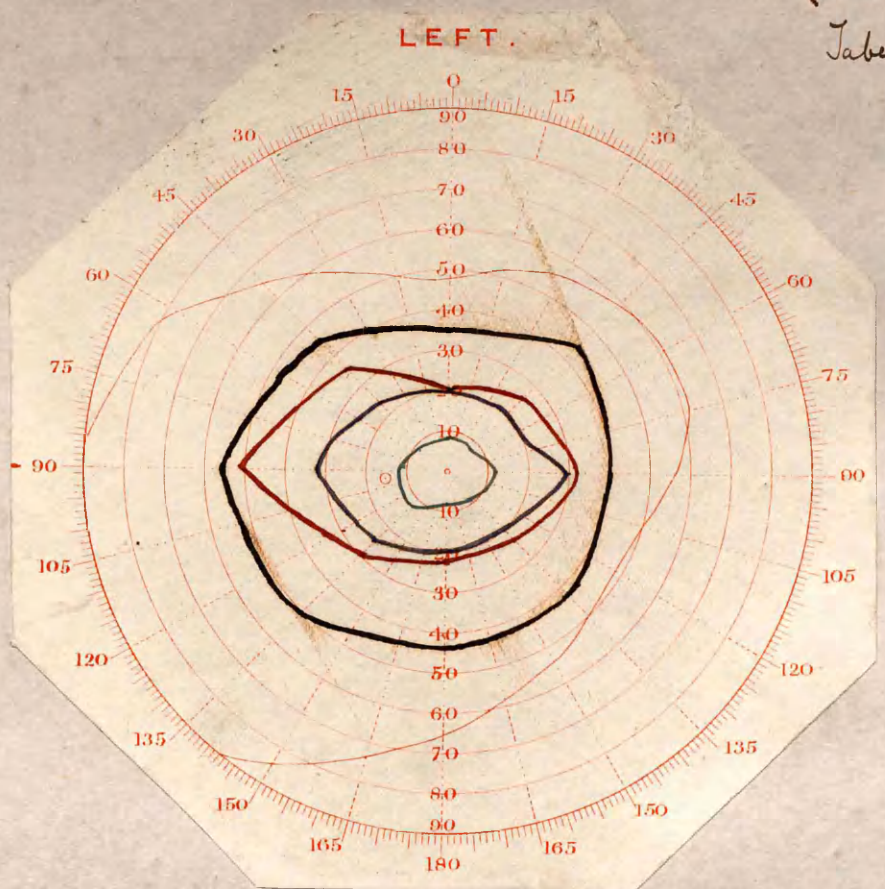
Case 34. page 101.

Andrew McK. aet. 31 No 53083

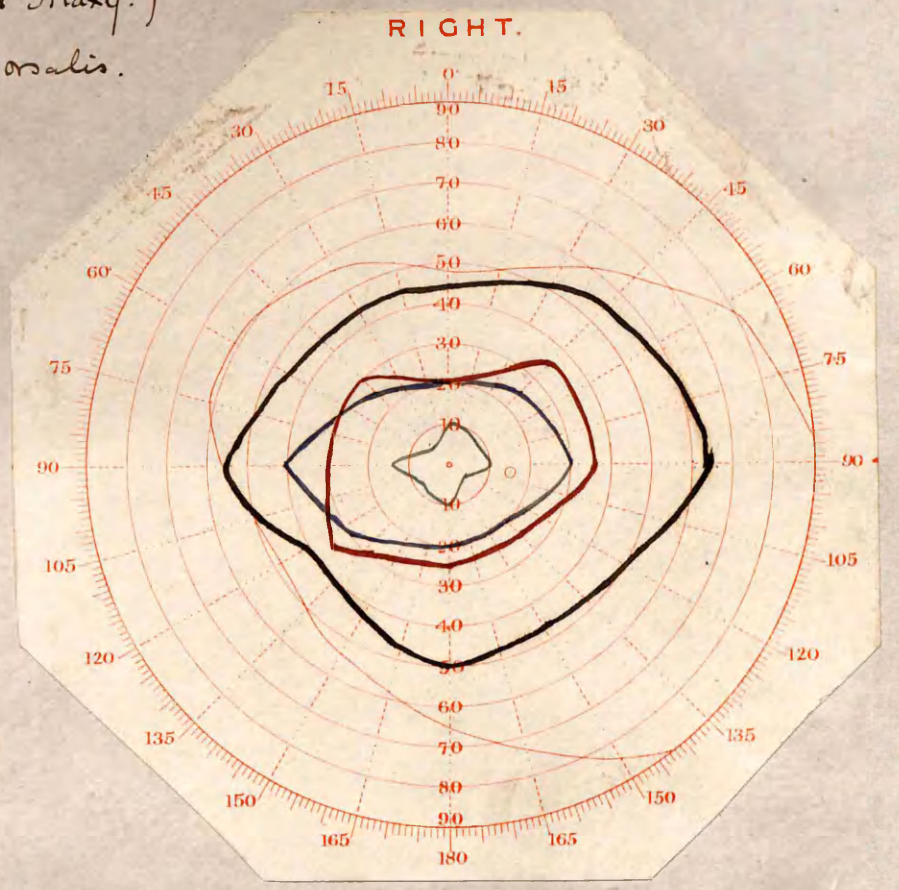
Plate XXXIV

(Locomotor Ataxy.)

Tabes Dorsalis.



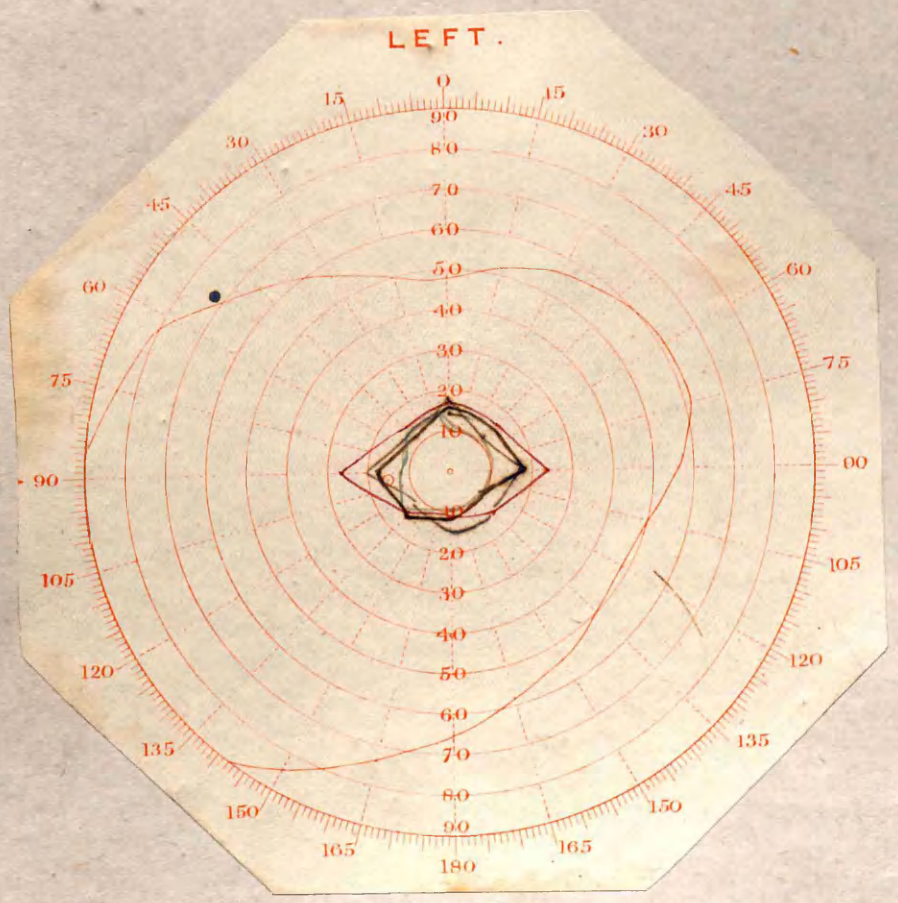
B



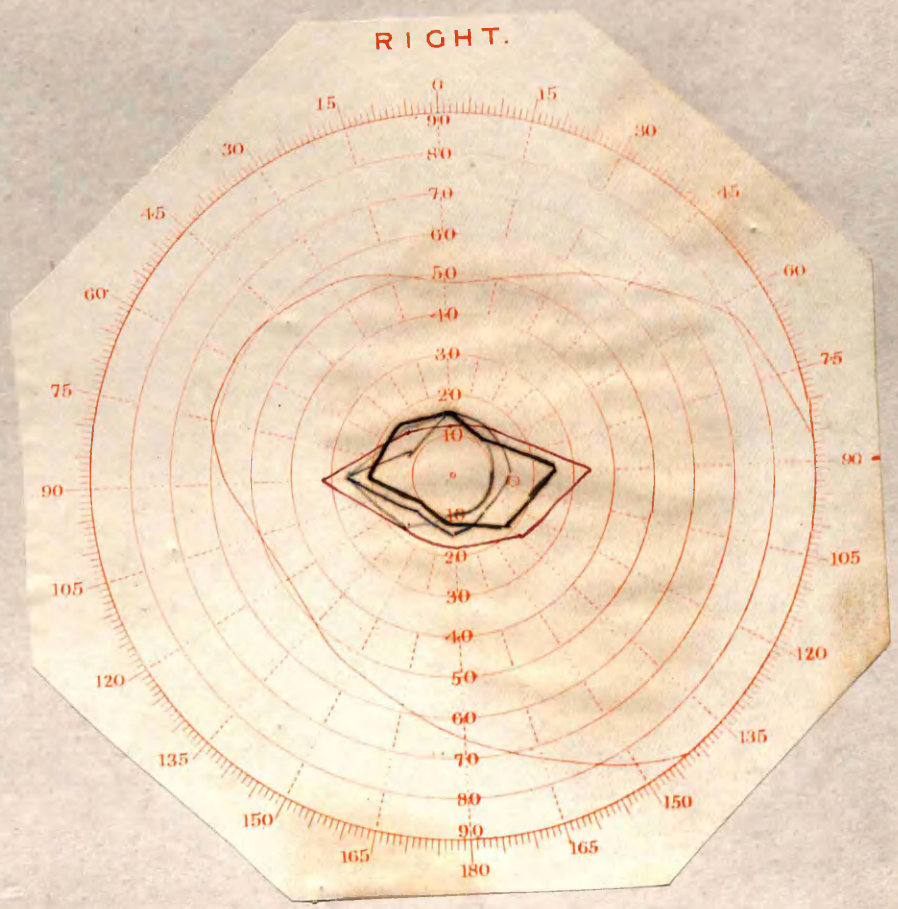
A

Aug. 10. 1887

Aug 10. 1887.



D



C

June 18: 1888

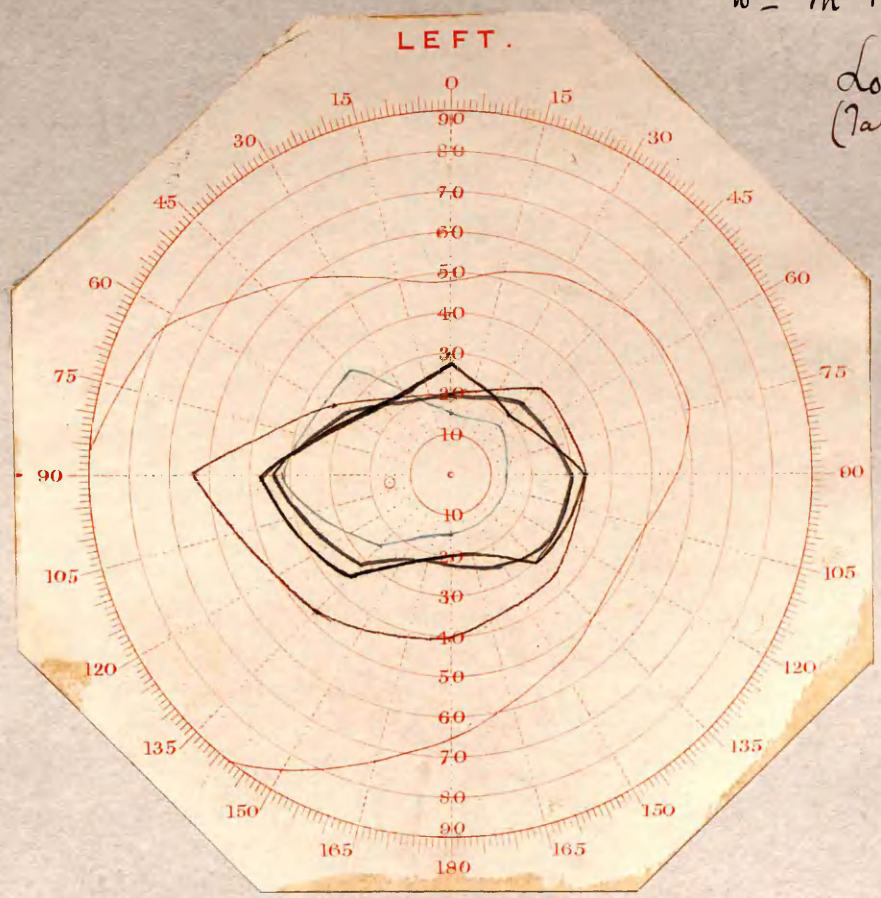
June 18: 1888

Case 35. p. 102

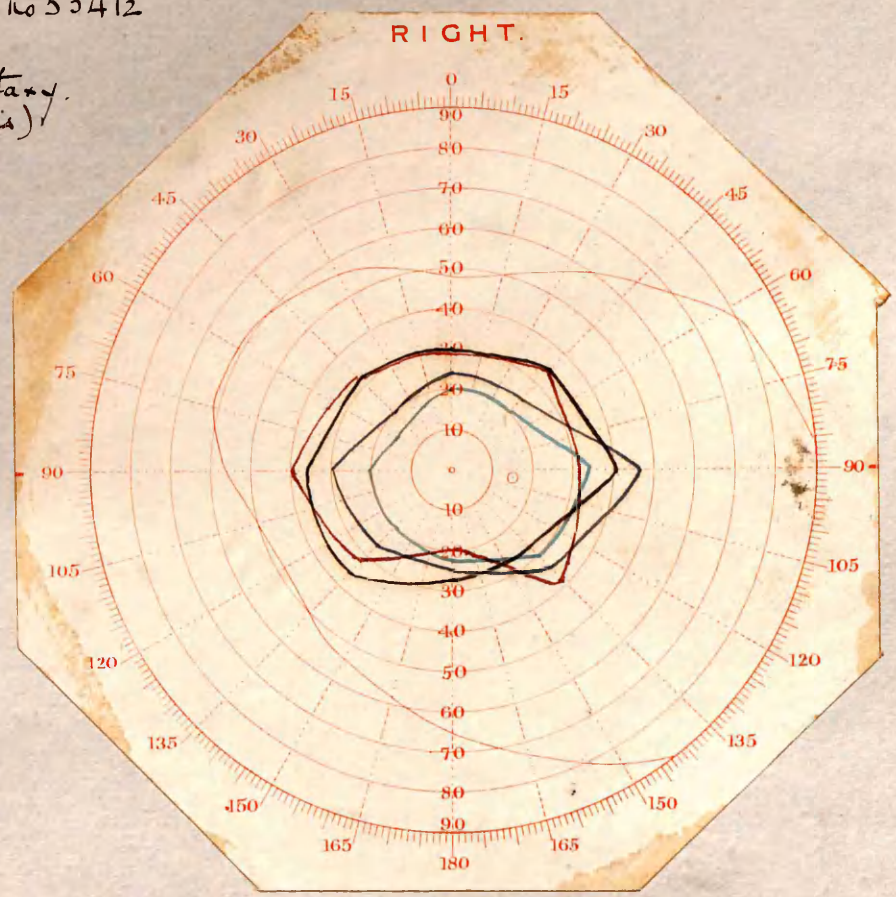
Plate XXXV

Wm McF. aet 60. No 53412

Locomotor Ataxy.
(Tabes dorsalis)



B



A

Plate XXXVI

Case 36. p105

Robt S. aet 32. 56028

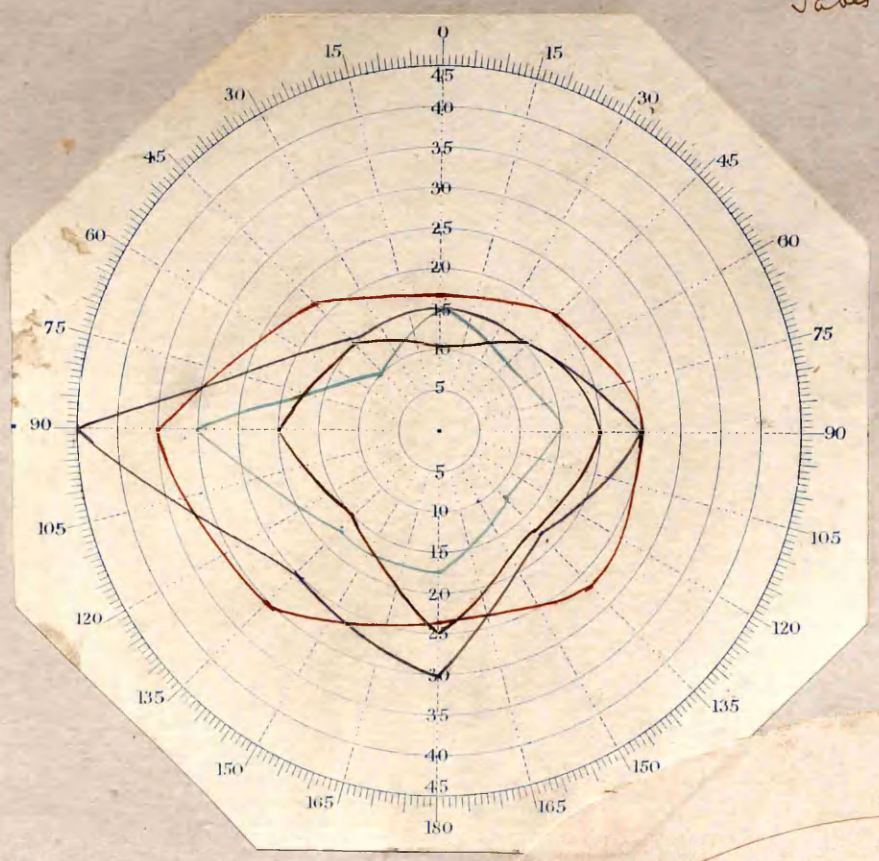
L

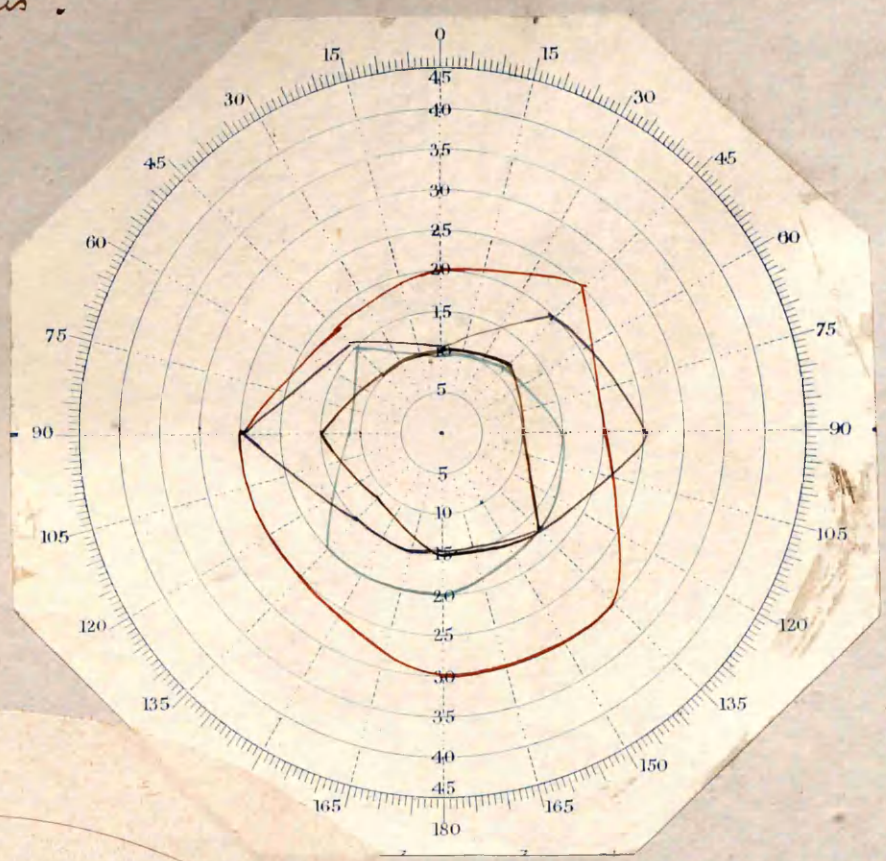
Tabes dorsalis?

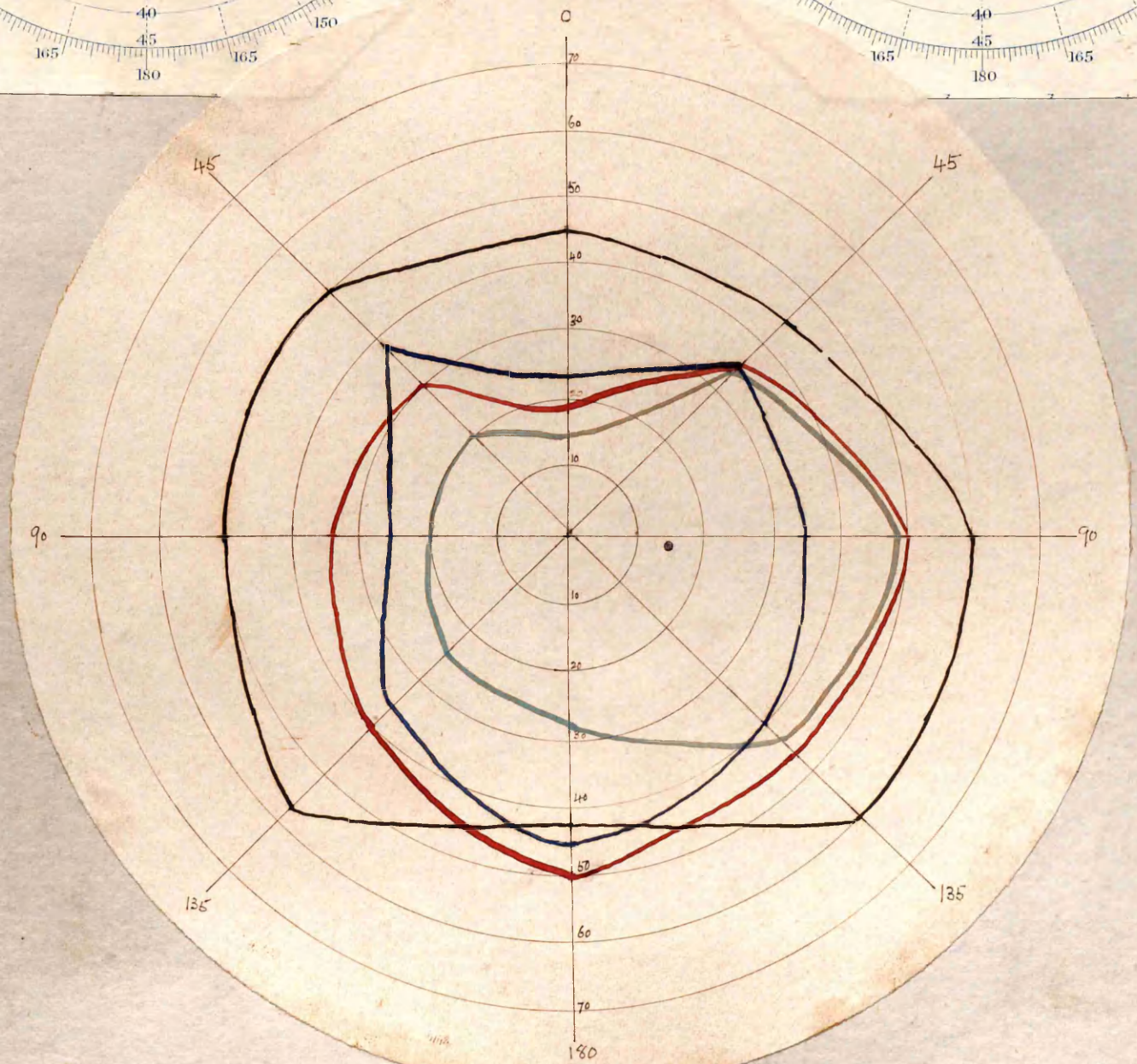
R

B

A





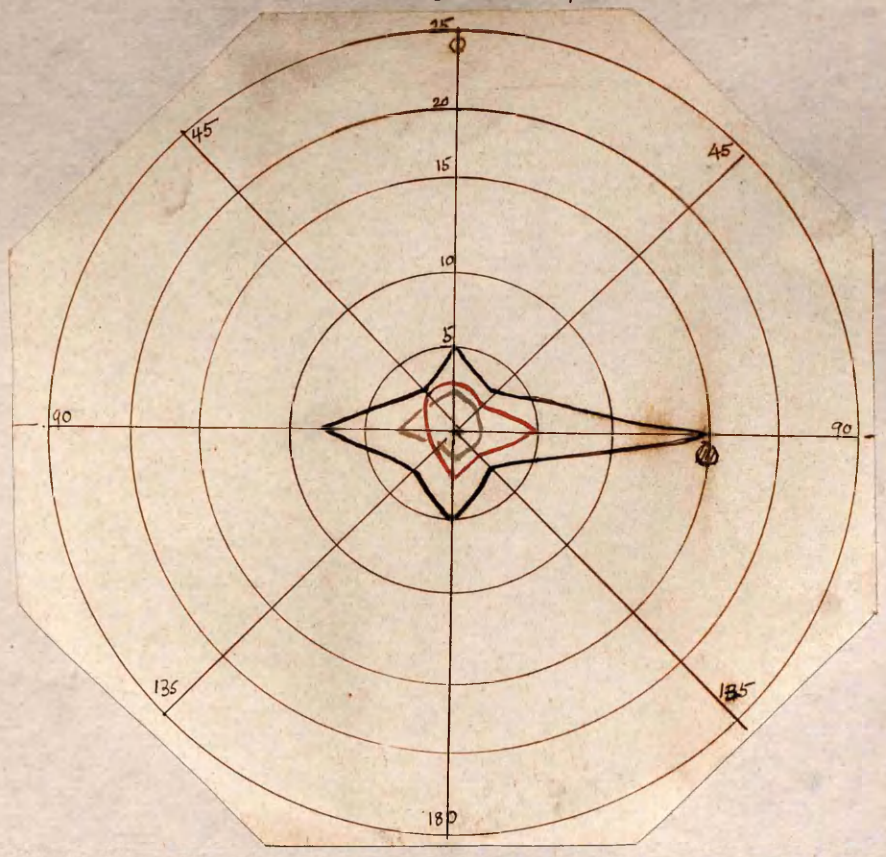


d

Kate McP. aet 25.
no 53045.

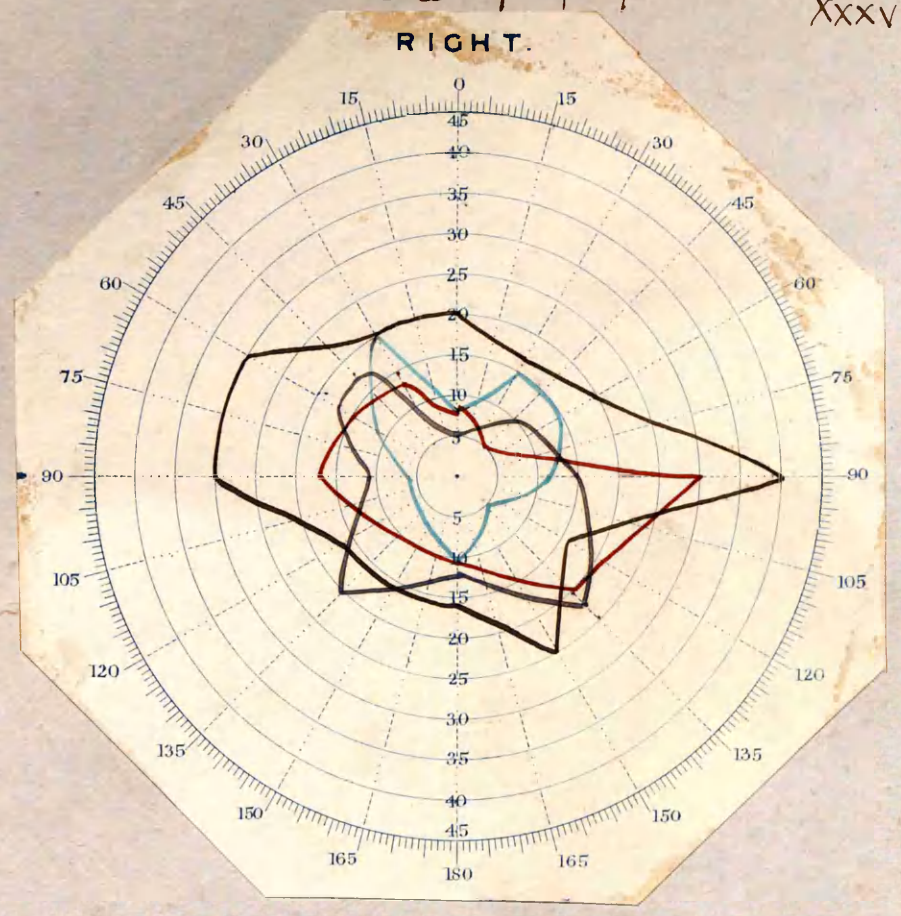
U.
(Case of Dr. Finlayson)
Case 38. p. 108

B



Henry B. aet. 53 53382
Case 37. p 107

Plate XXXVII



A

Case. 39. page 111

Plate XXXVIII

David D.. aetat: no 52626

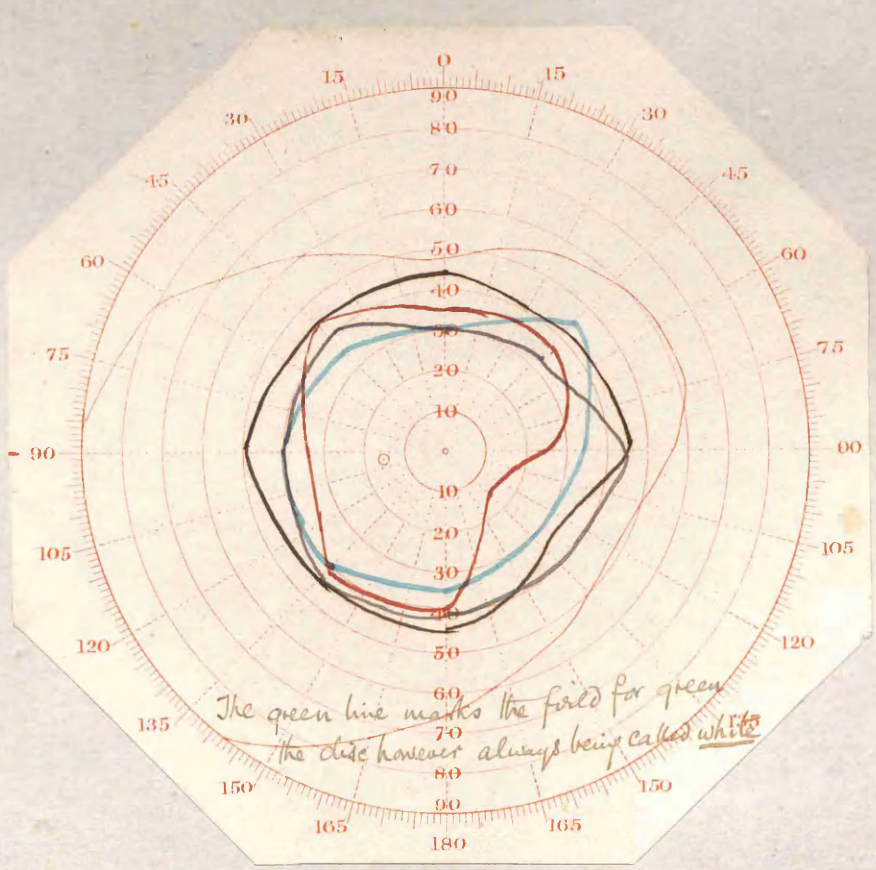
(1)

L

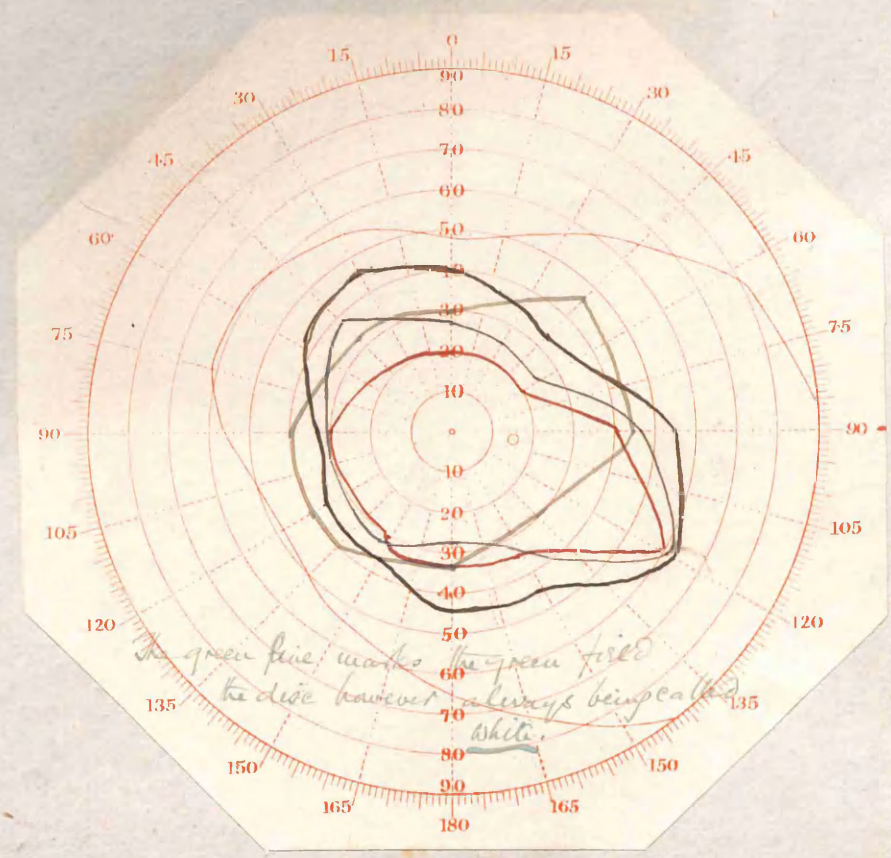
R

B

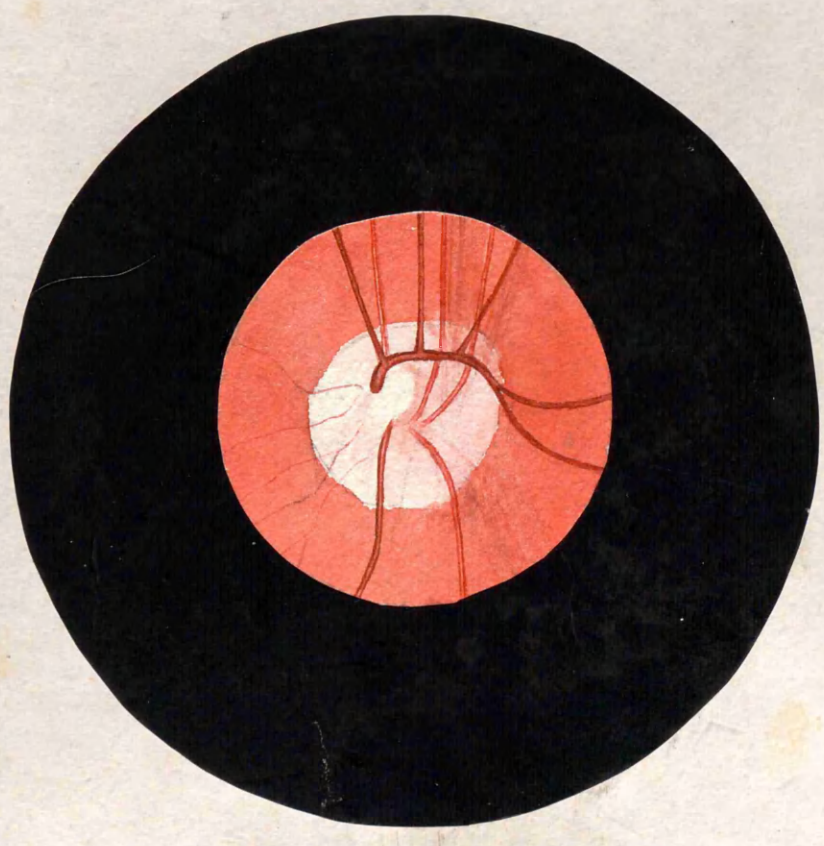
A



July 26: 87



July 26: 87.



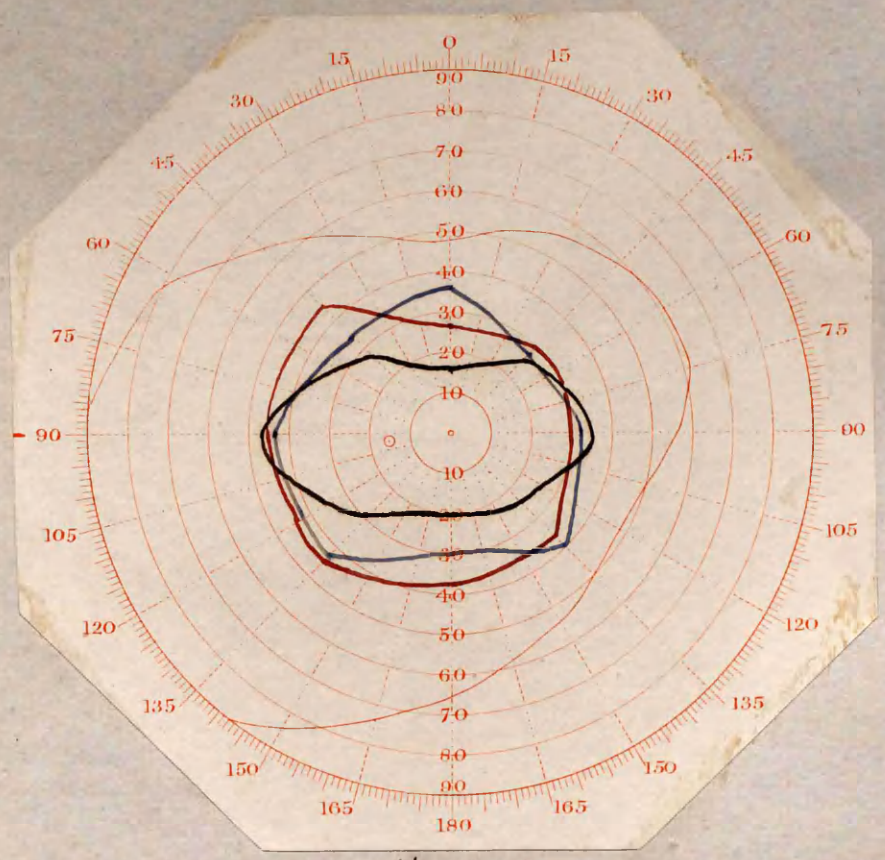
Case 39. page 111

David D. aet. 19. no 52626

2

Plate XXXIX

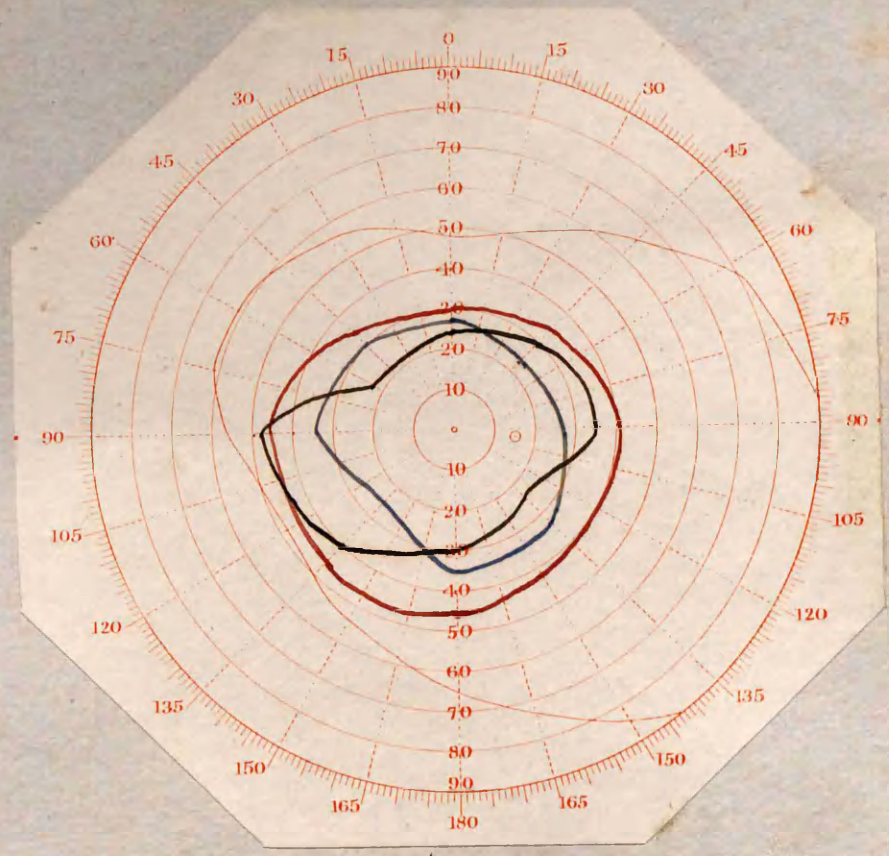
LEFT.



B

Sept. 13: 87

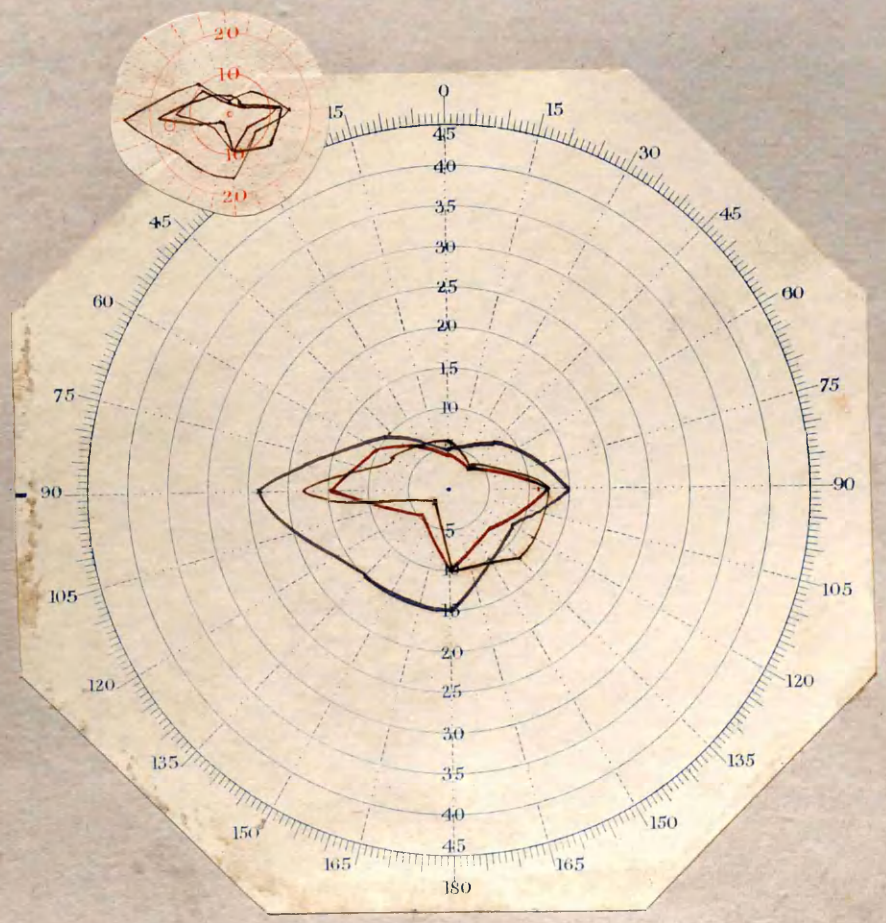
RIGHT.



A

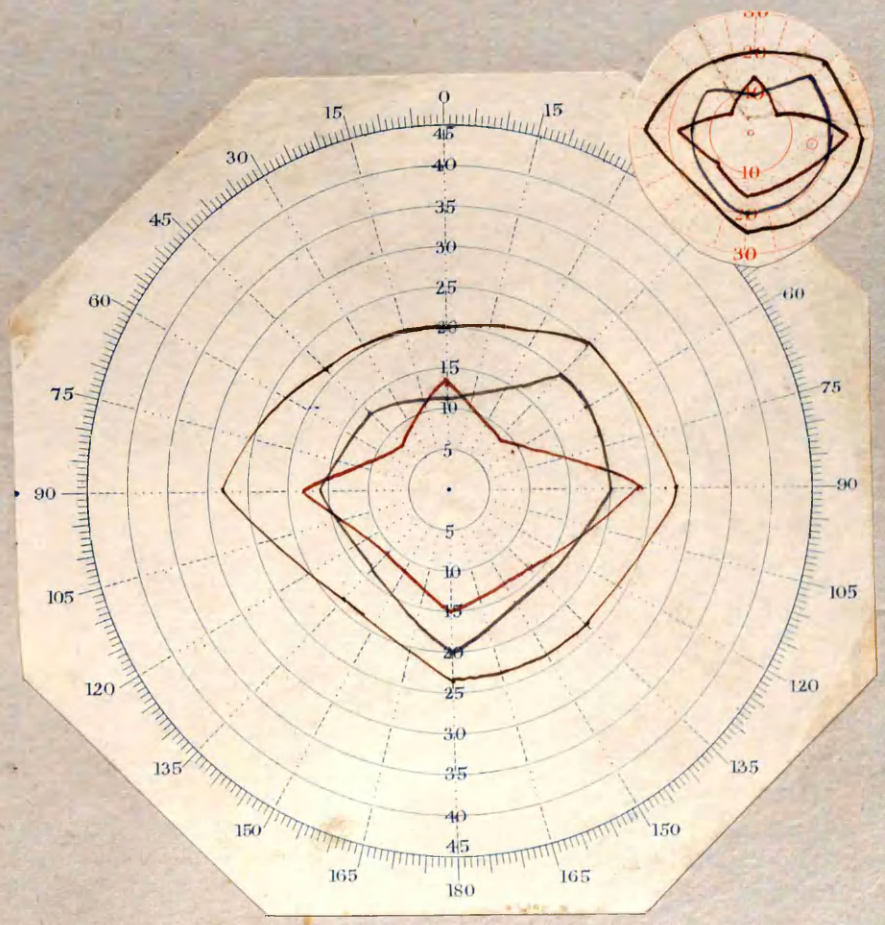
Sept 13: 87

A



Nov. 22. 87

C



Nov. 22. 87.

Plate XL

Patrick C. aet: 58 (S. Gairdner's case)

Case 40. p117

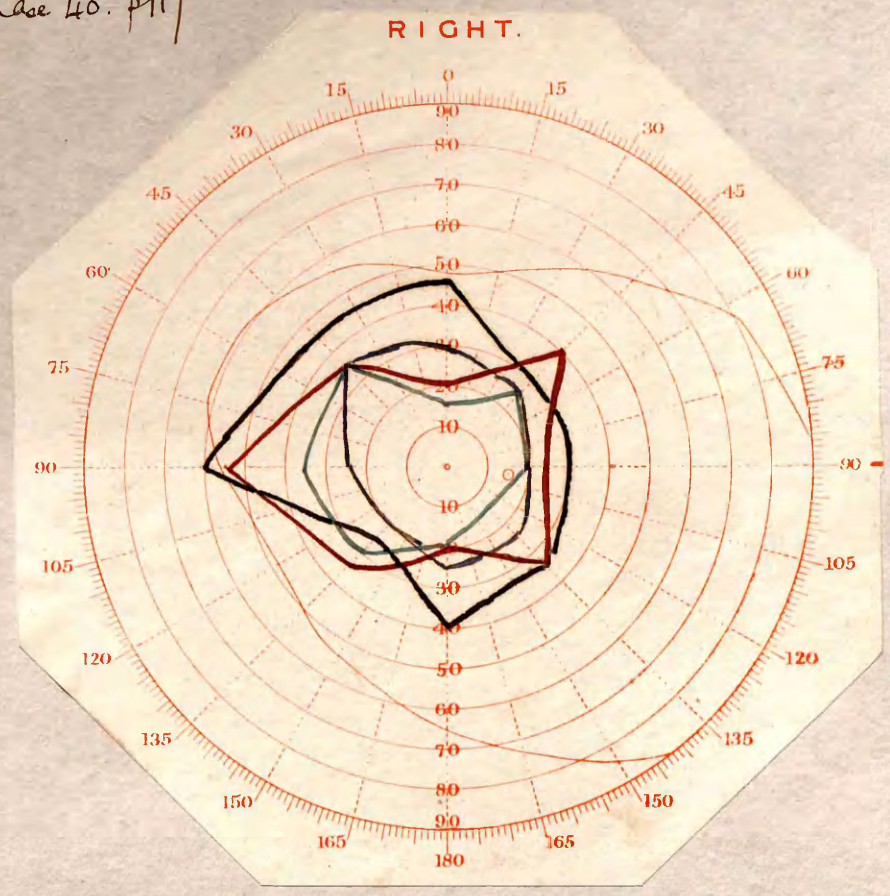
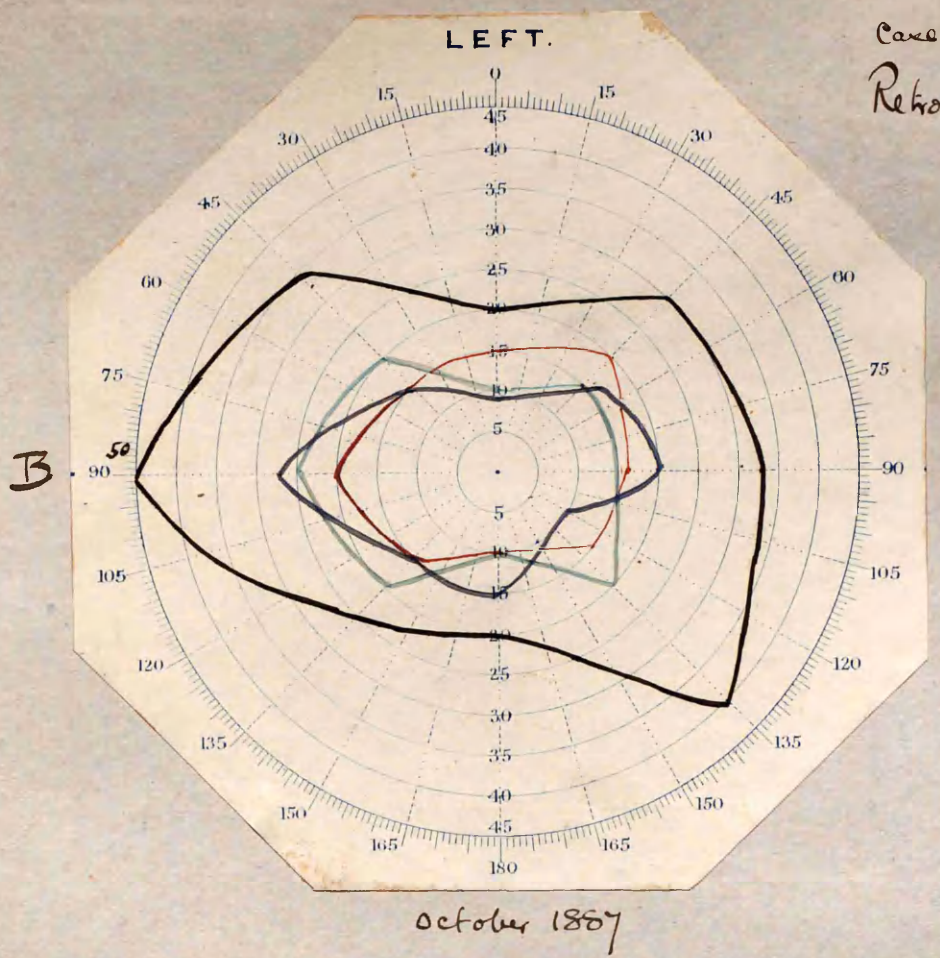
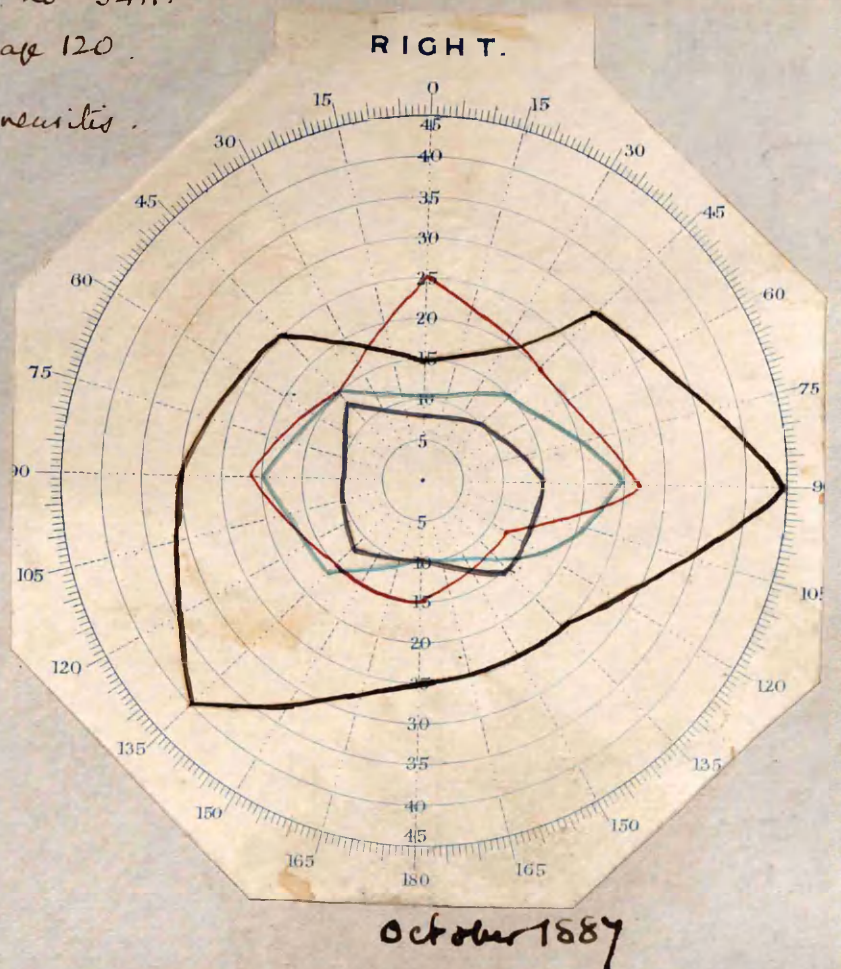
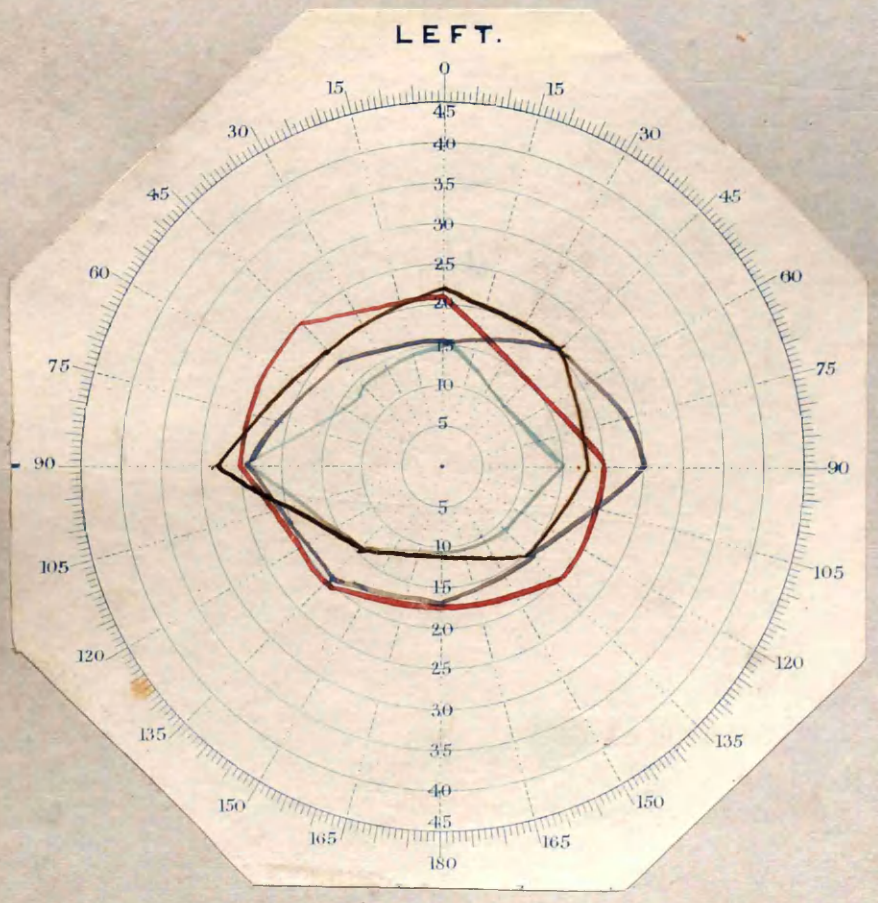


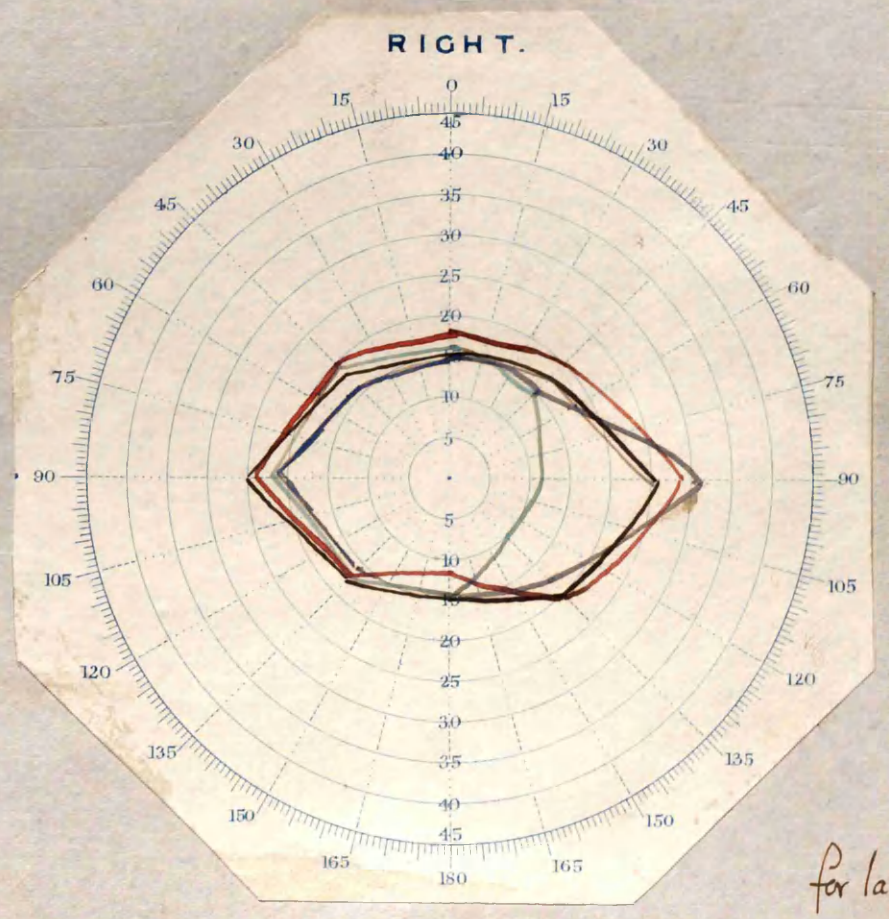
Plate XLI

Ms. C. alt 42 no 53411.
Case 41. page 120.
Retrobulbar neuritis.









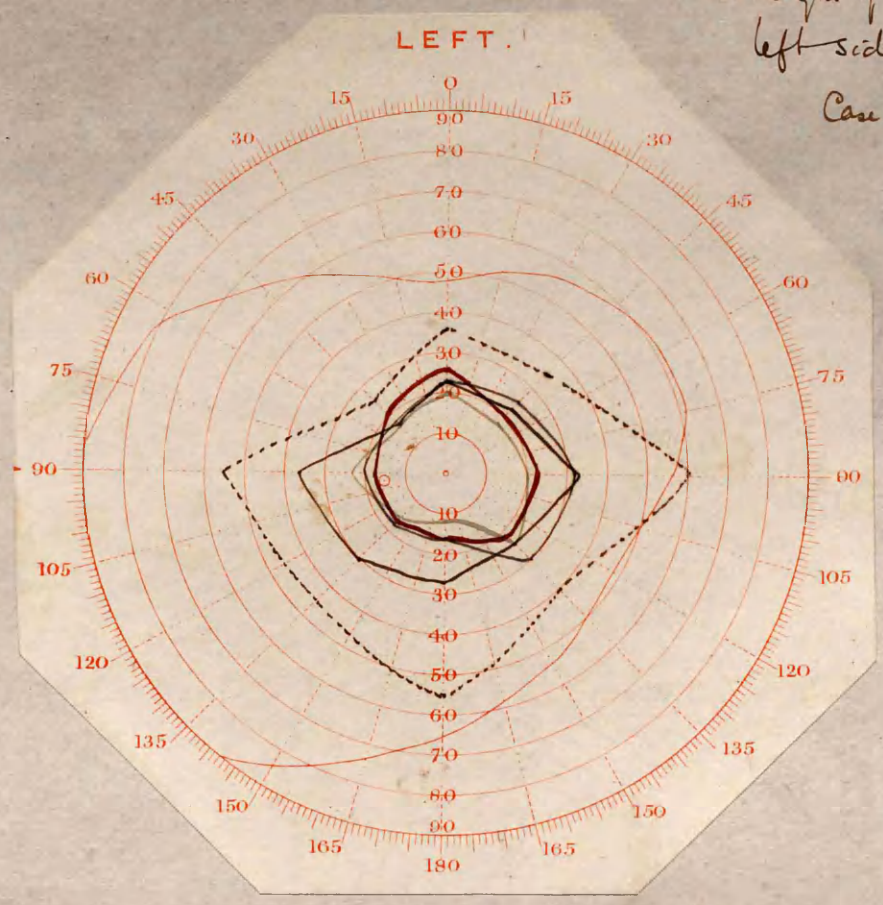
for later fried
See plate XLII.

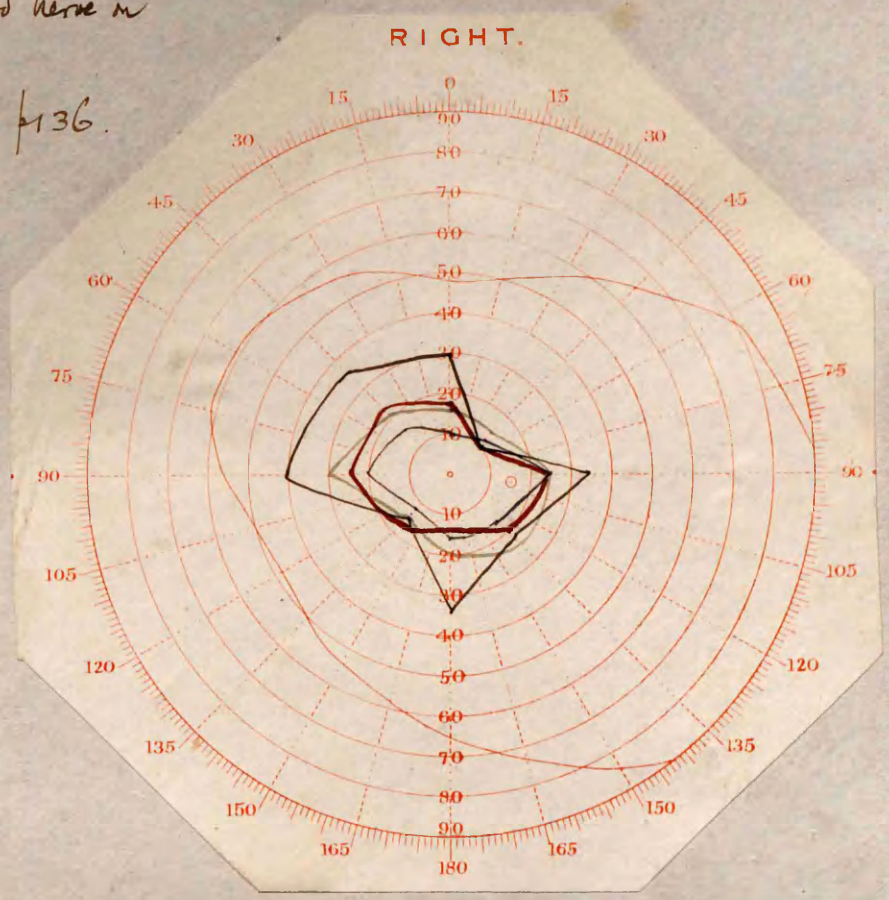
Plate XLII

Patrick J. aet. 37. no 54544. (Case of Dr. Coats)

Paralysis of Third Nerve on left side.

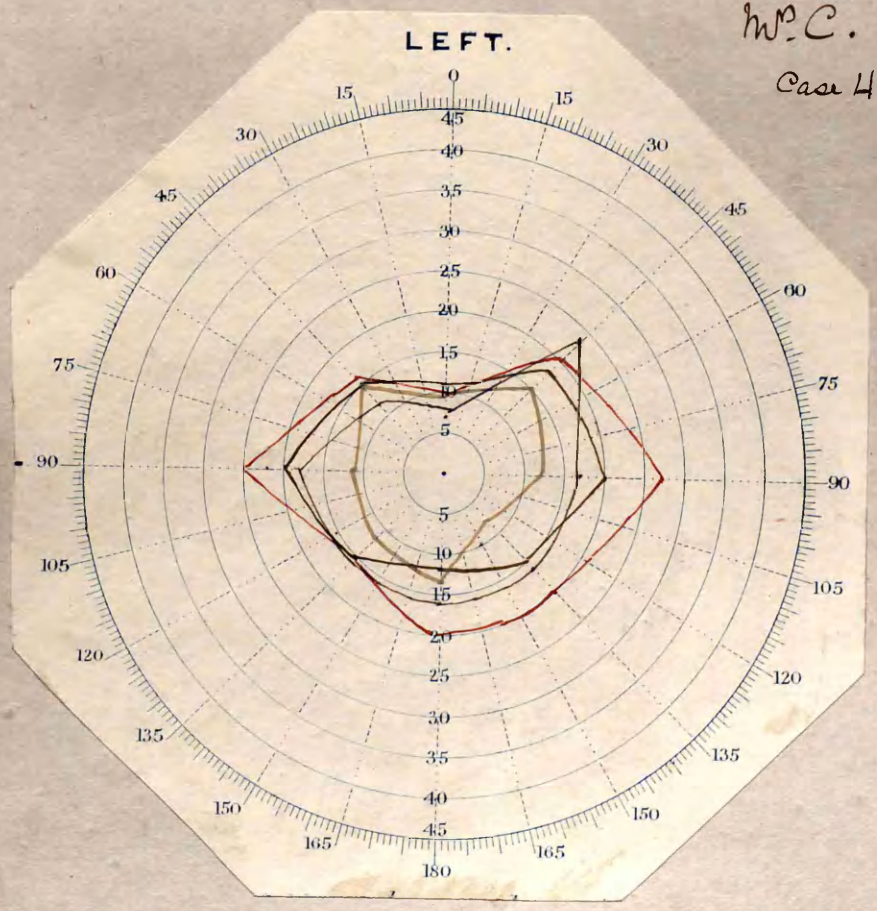
Case 42. p 136.



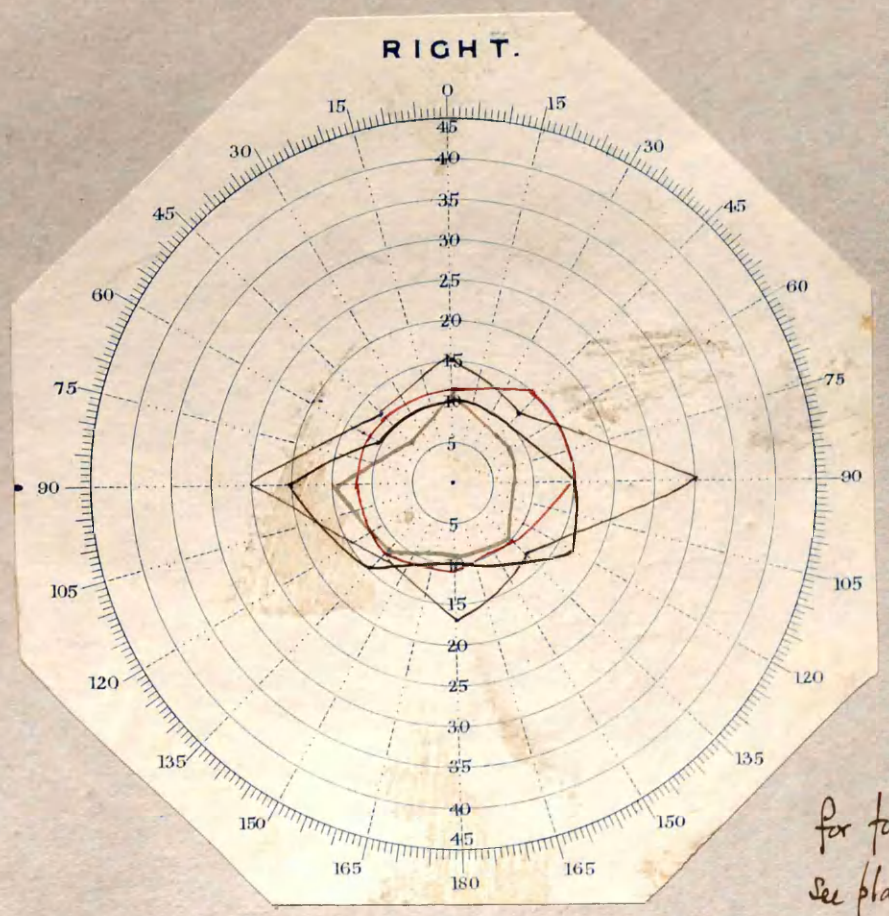


Mr C.

Case 41.



June 1888

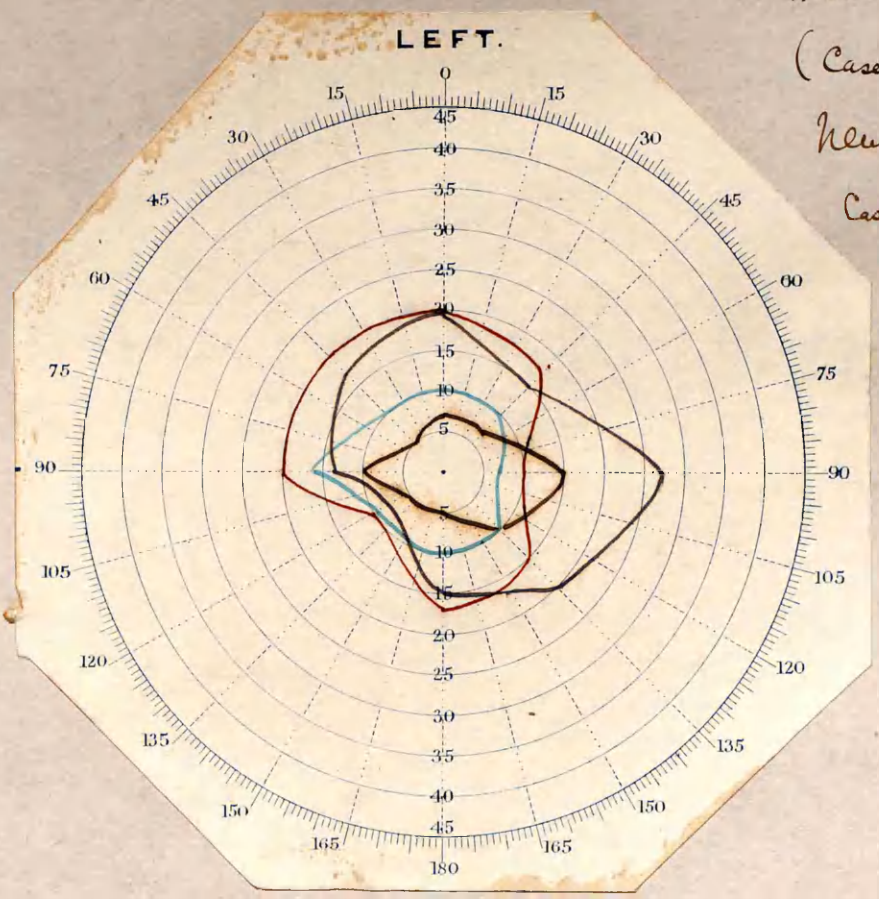


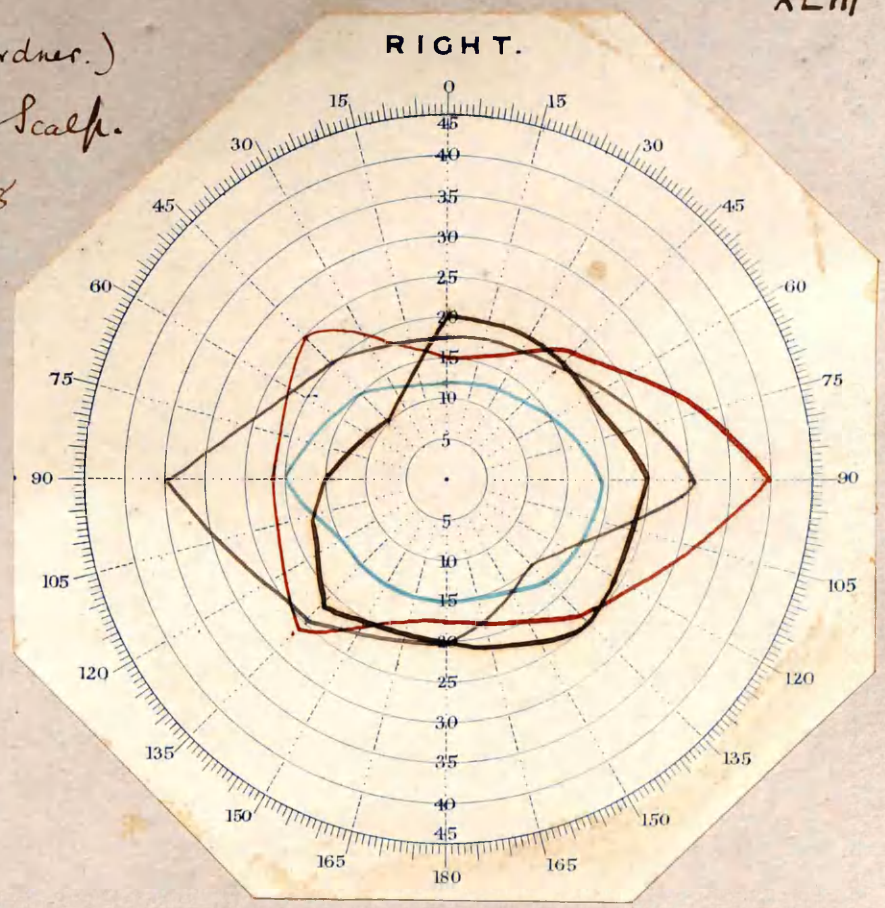
June 1888

for former fields see plate XLI.

Plate
XLIII

S. aet.
(Case of Dr Gairdner.)
Neuralgia of Scalp.
Case 43. p128





Agnes M-L: aet. 24. No 5679

Papillitis

Case 44. fig 31.

Plate XLIV

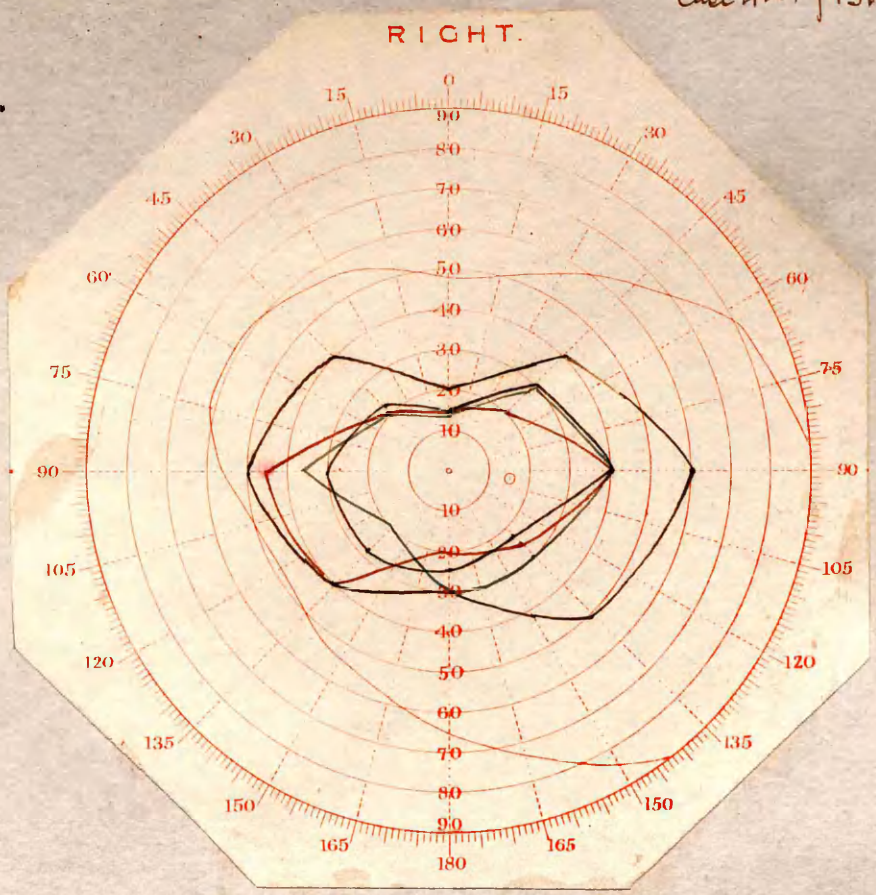
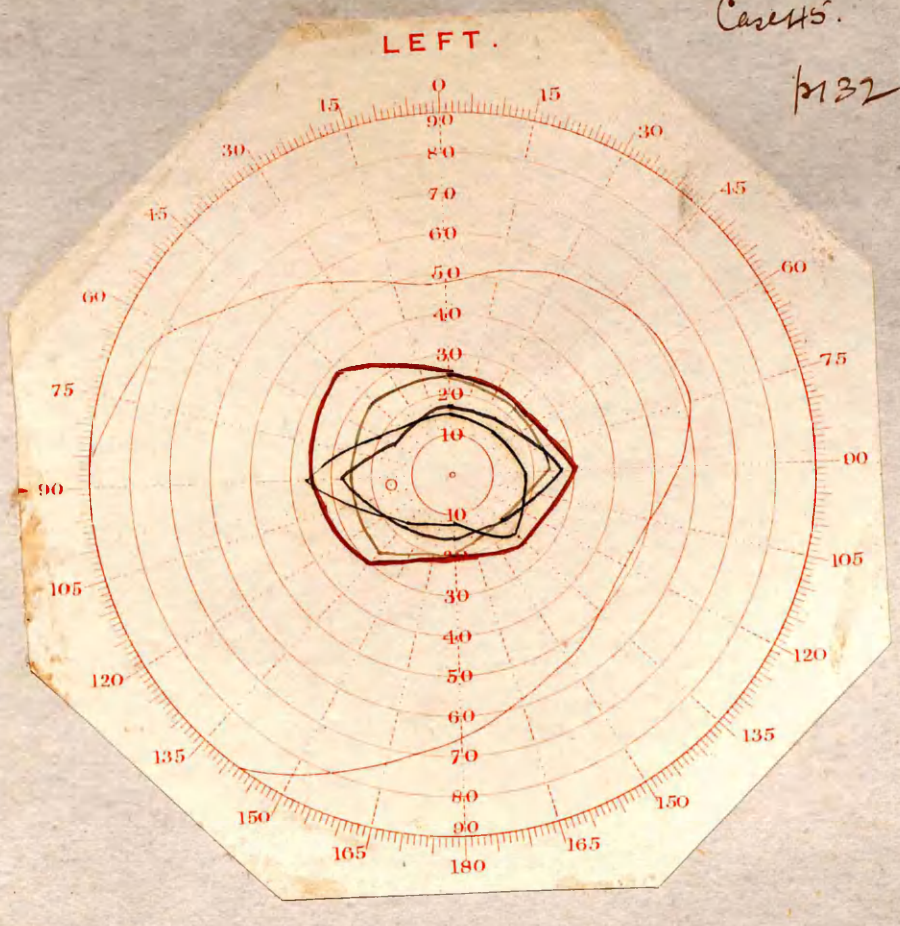


Plate XLV

Robt H. aet 24. ho 54774.

Case 45.

M32

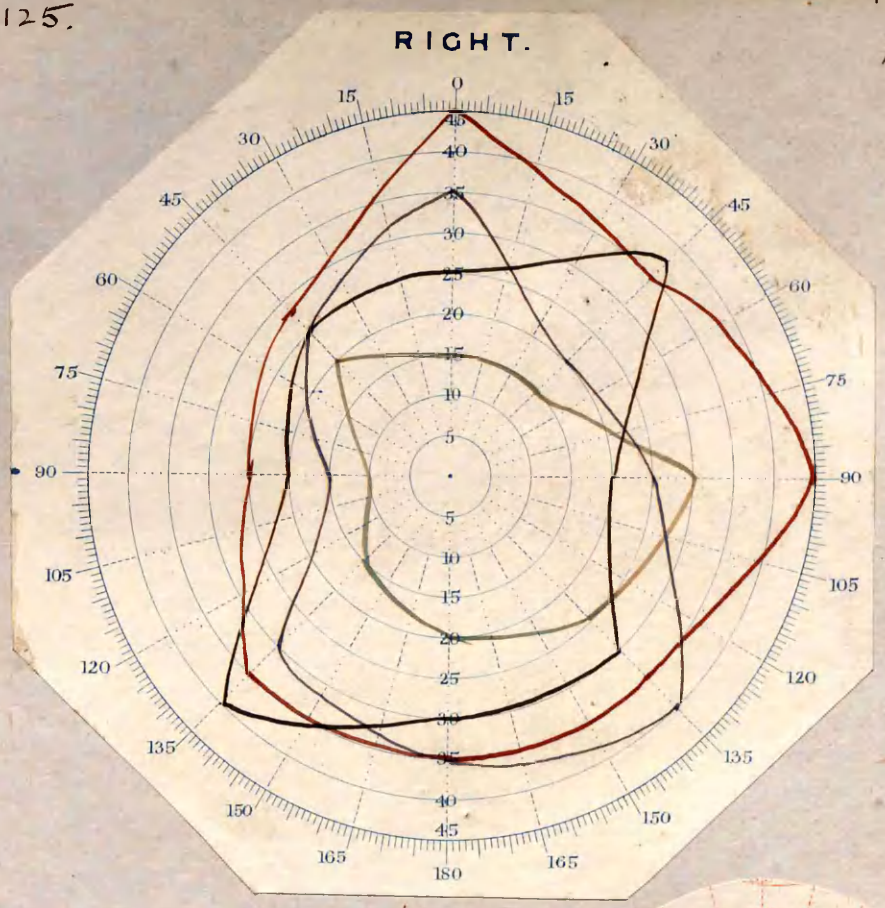


Ronald Med. acct. 43. No 53125.

Case 46. page 134

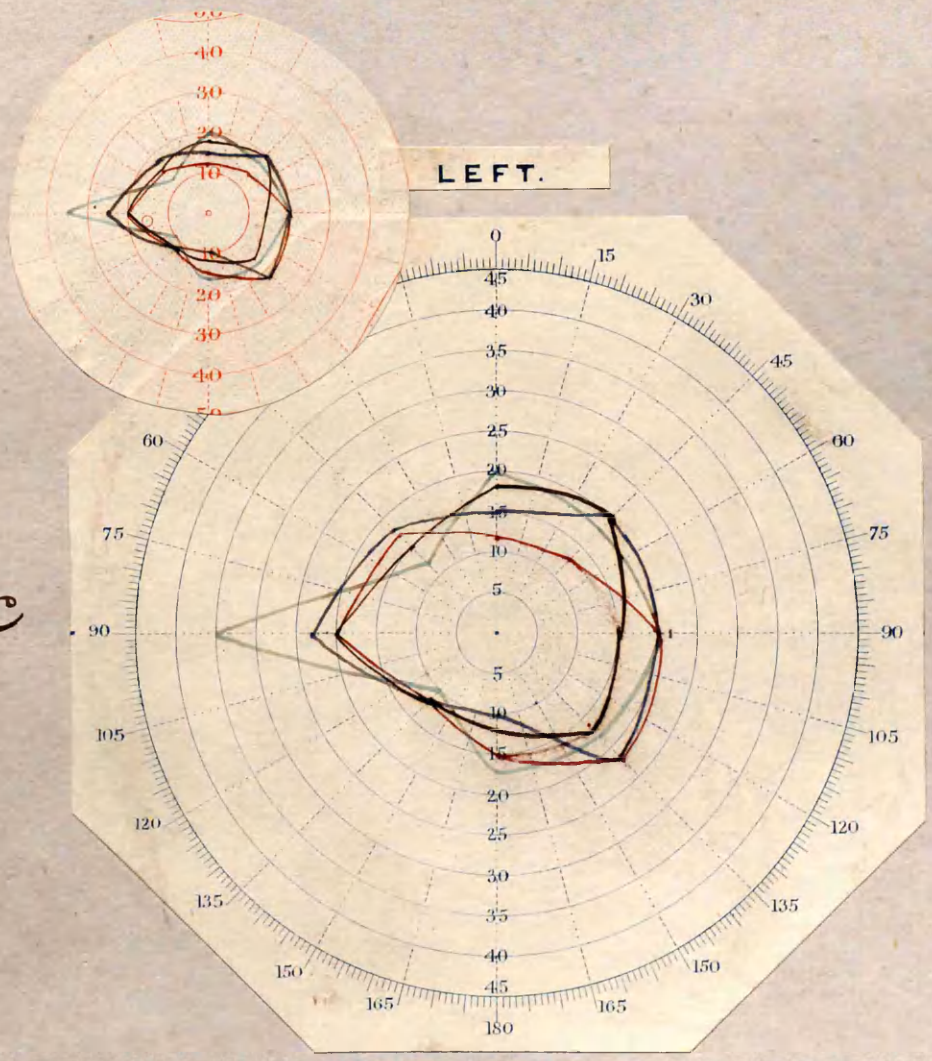
Plate XLVI

A



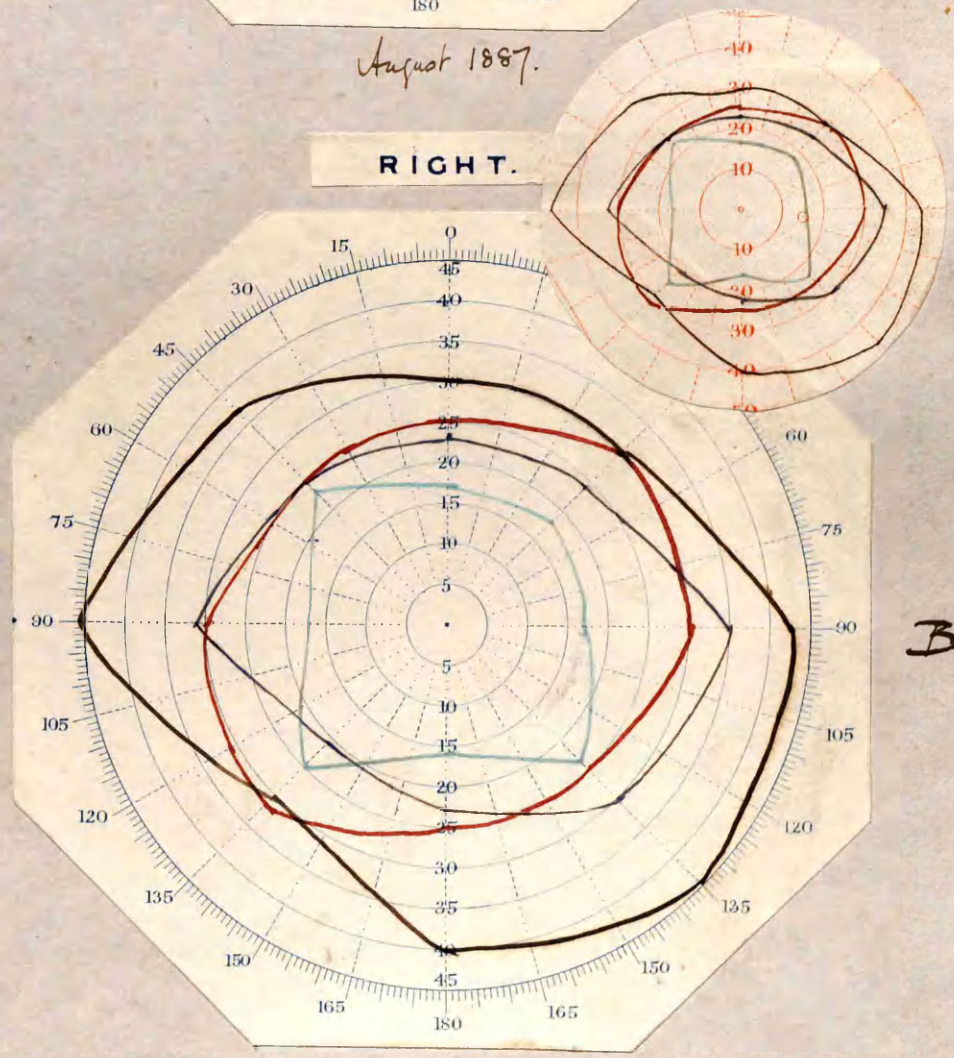
August 1887.

C



Oct: 22: 87

B



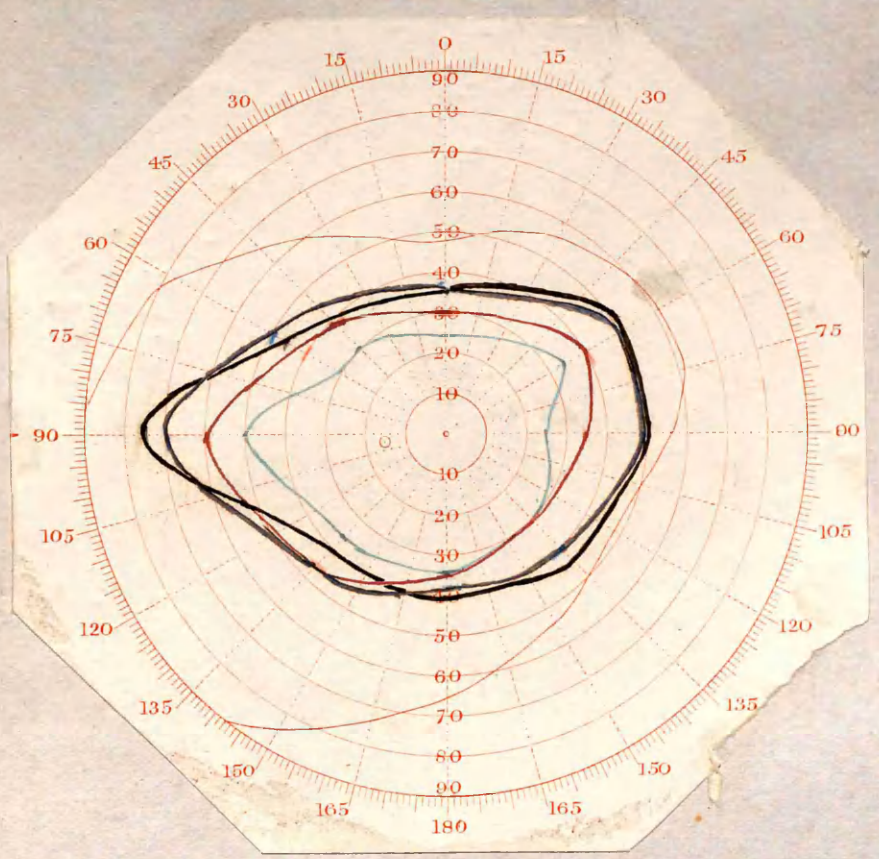
Oct 22: 87.

John P. act 50. No 53135

Case 47. p. 135.

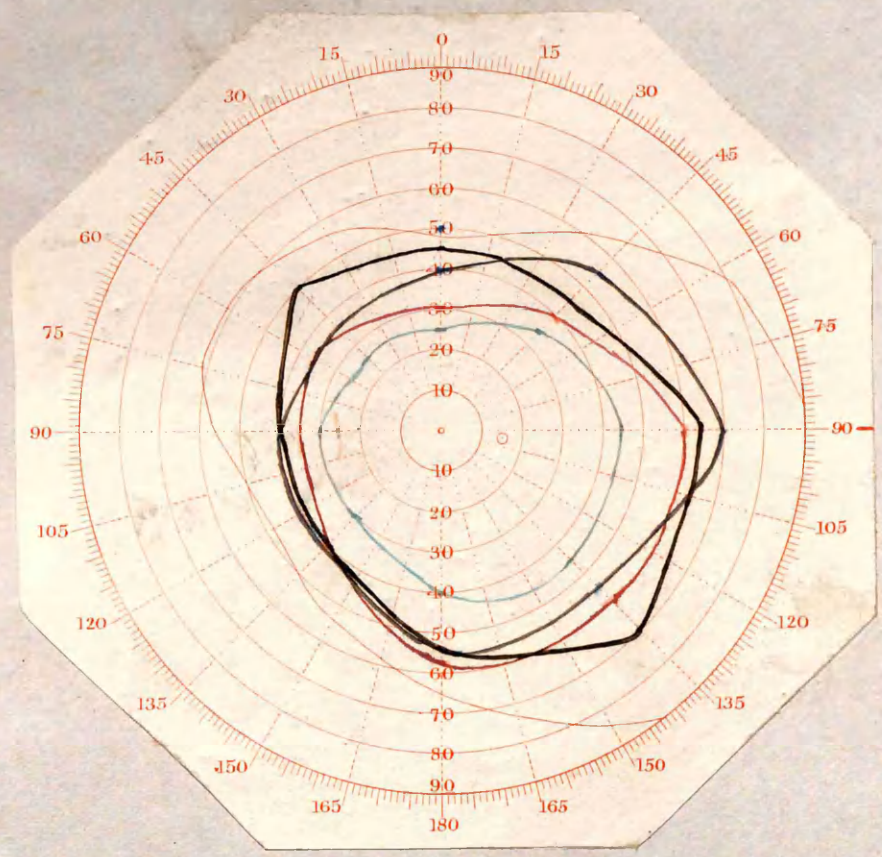
Plate XLVII

LEFT.



B

RIGHT.



A

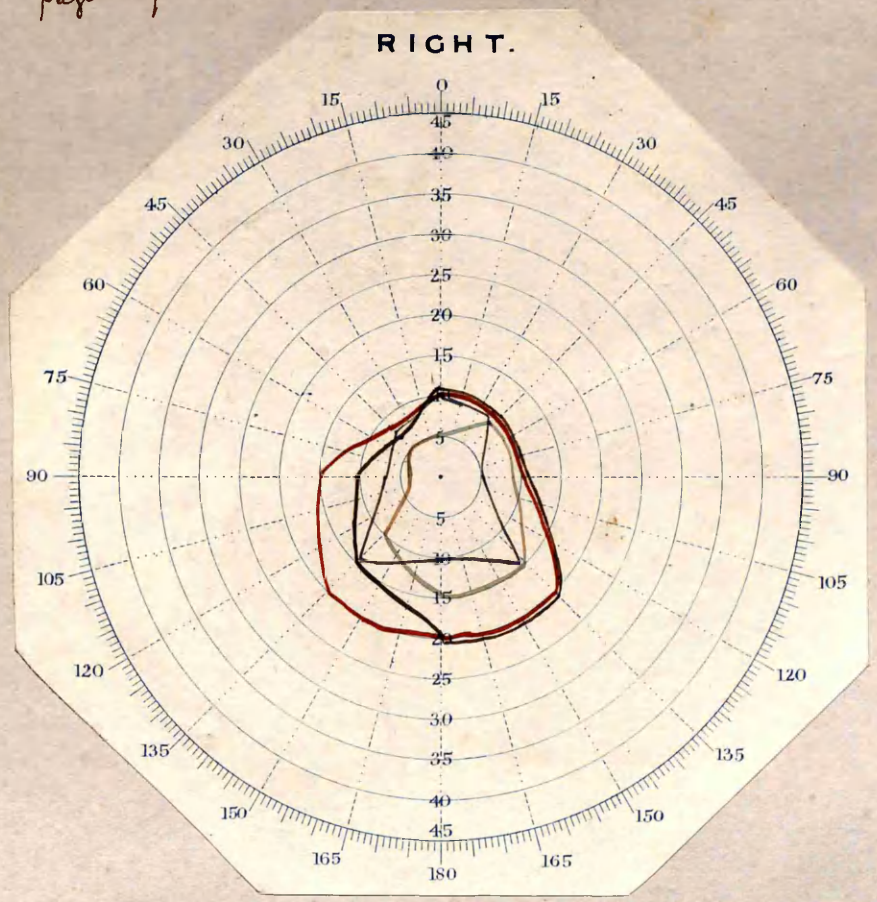
Case 48.
page 137.

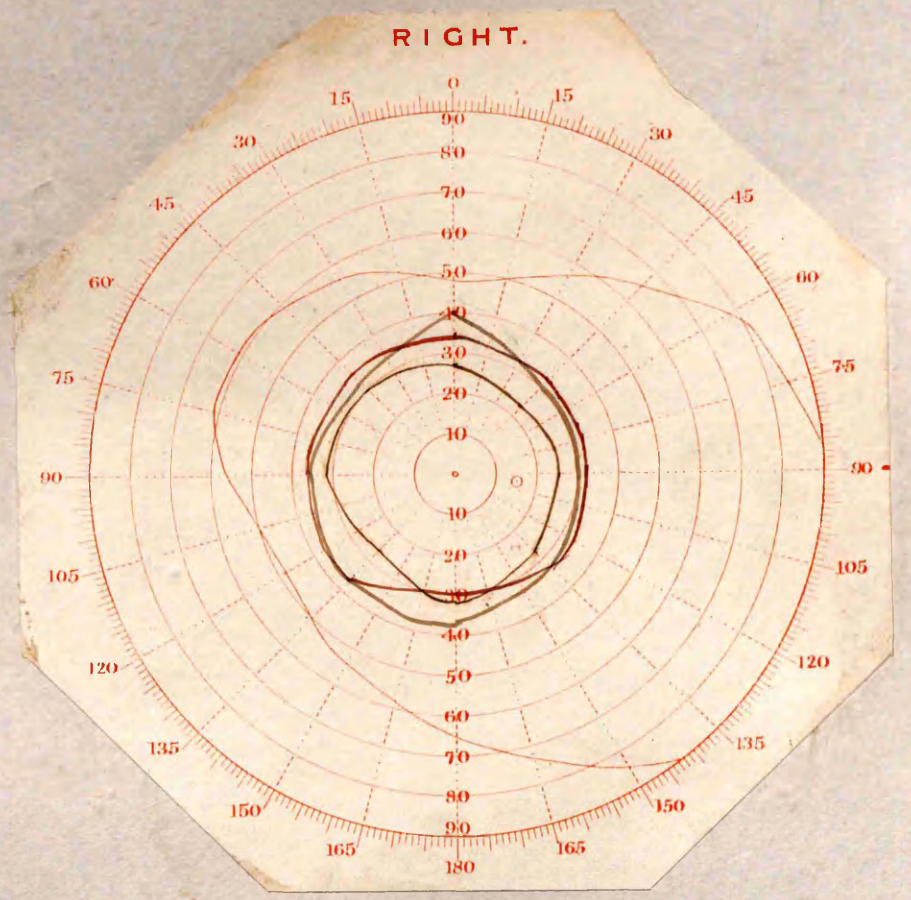
Geo. C. aet 38
51671
Locomotor Ataxy.

Alex: T. aet 43. no: 54652.
(D. Gairdner's case).

Plate
XLVIII

A





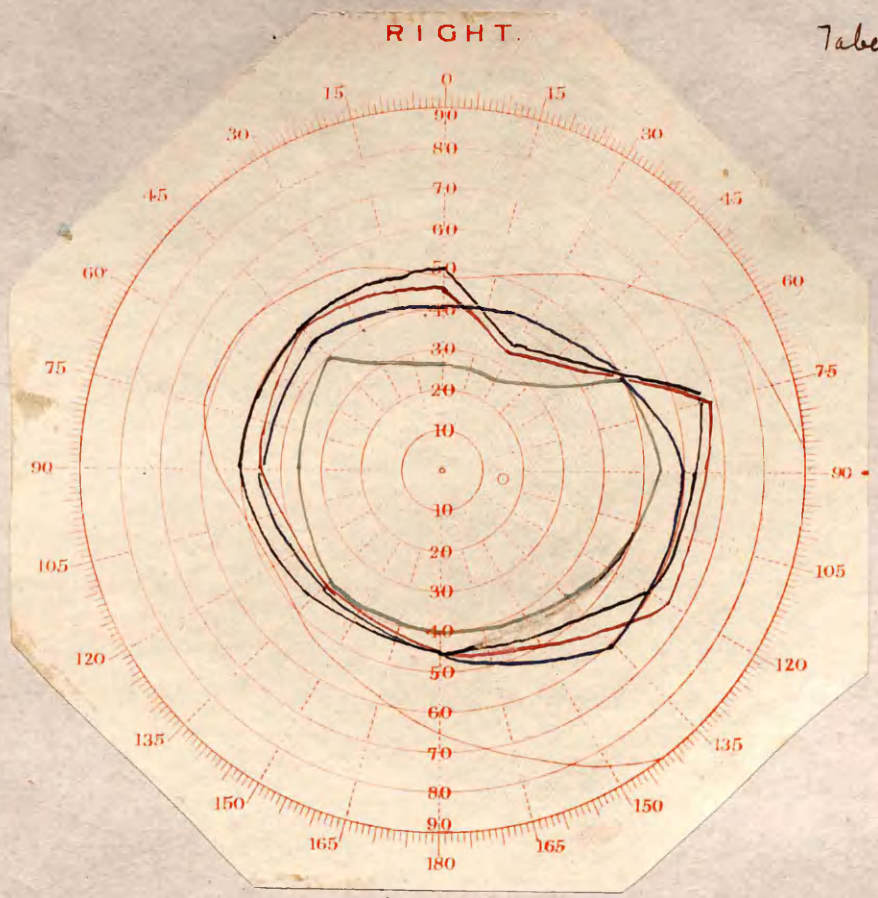
B

Case 49. 138

Plate XLIX

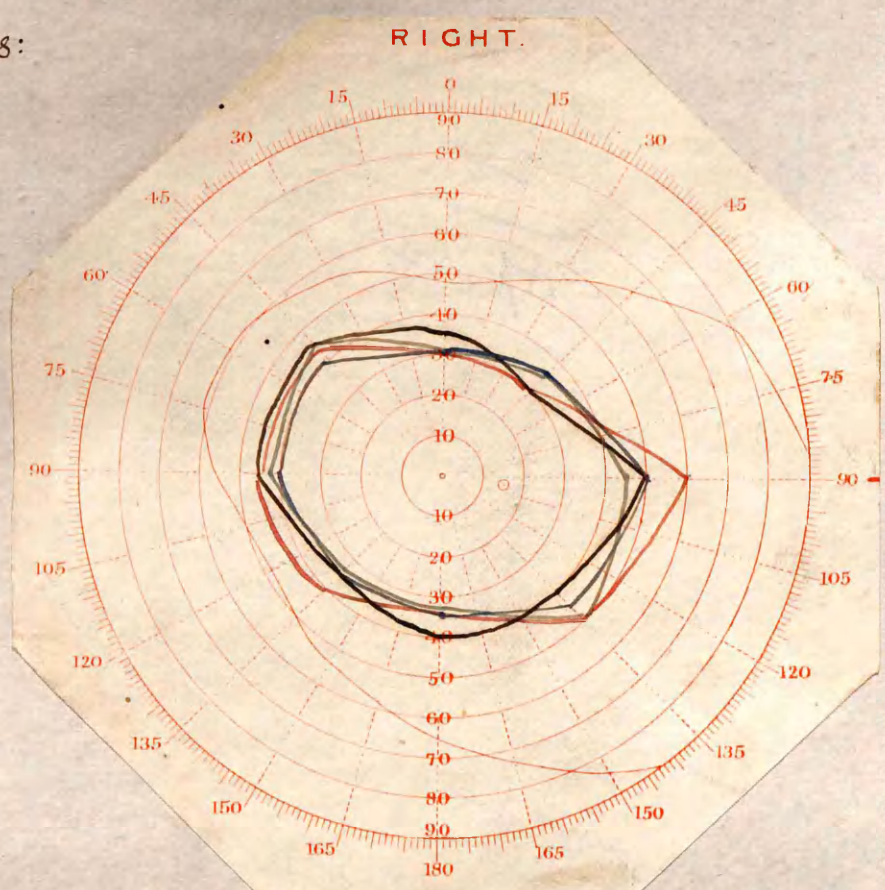
May McL. act 40. no 51730.

Tabes Dorsalis:



A

May. 1887



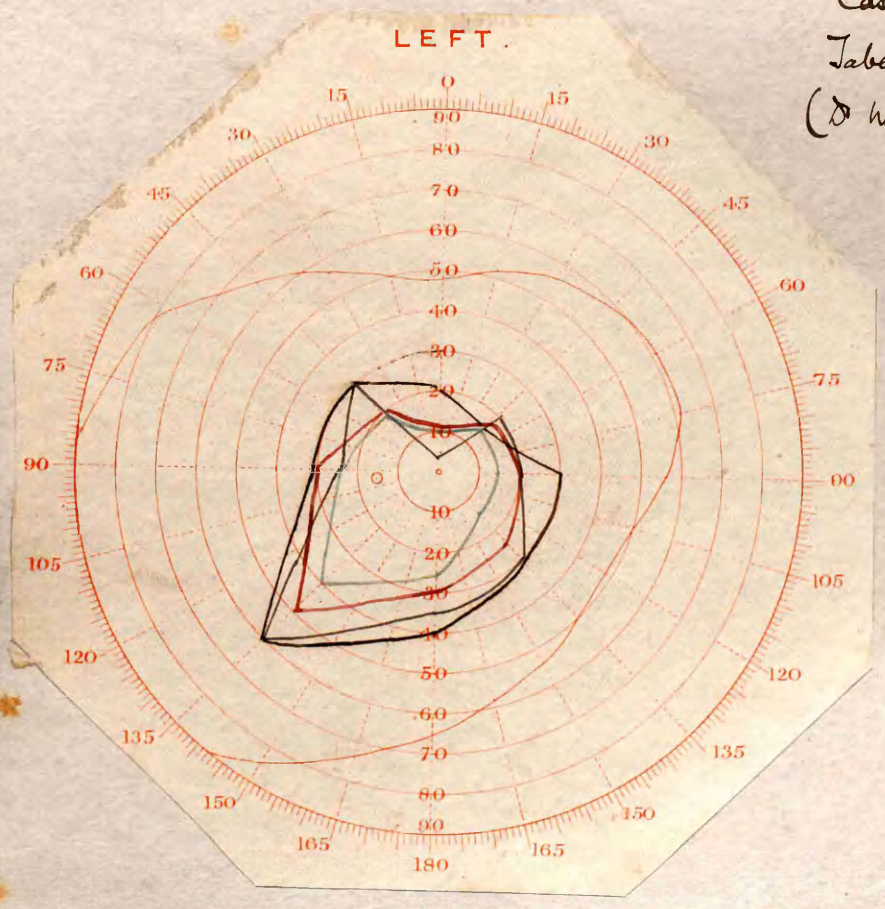
B

April 1888

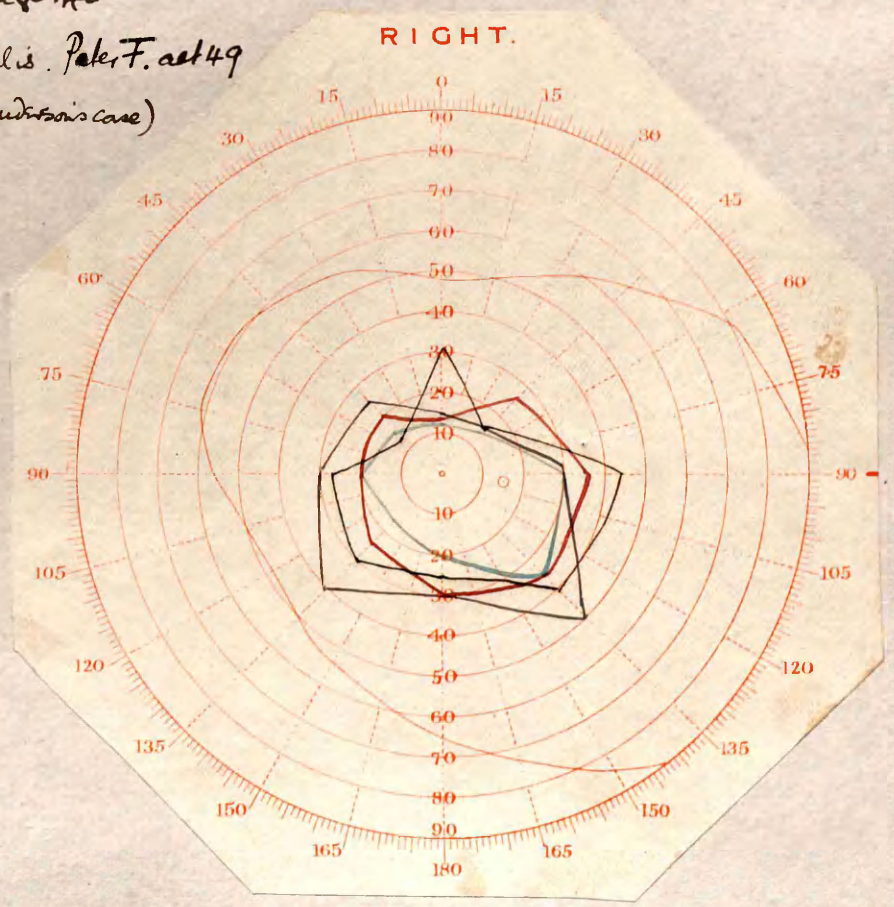
Case 50. page 140

Tabes Dorsalis. Peter F. act 49

(D McCall Anderson's case)



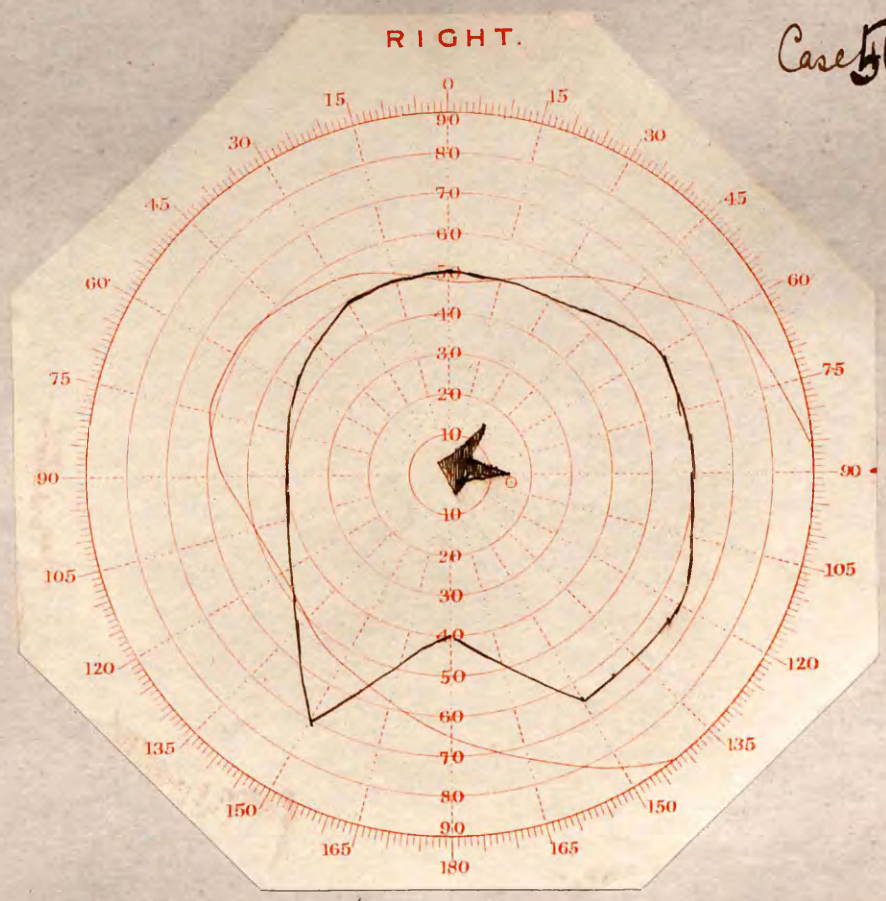
A



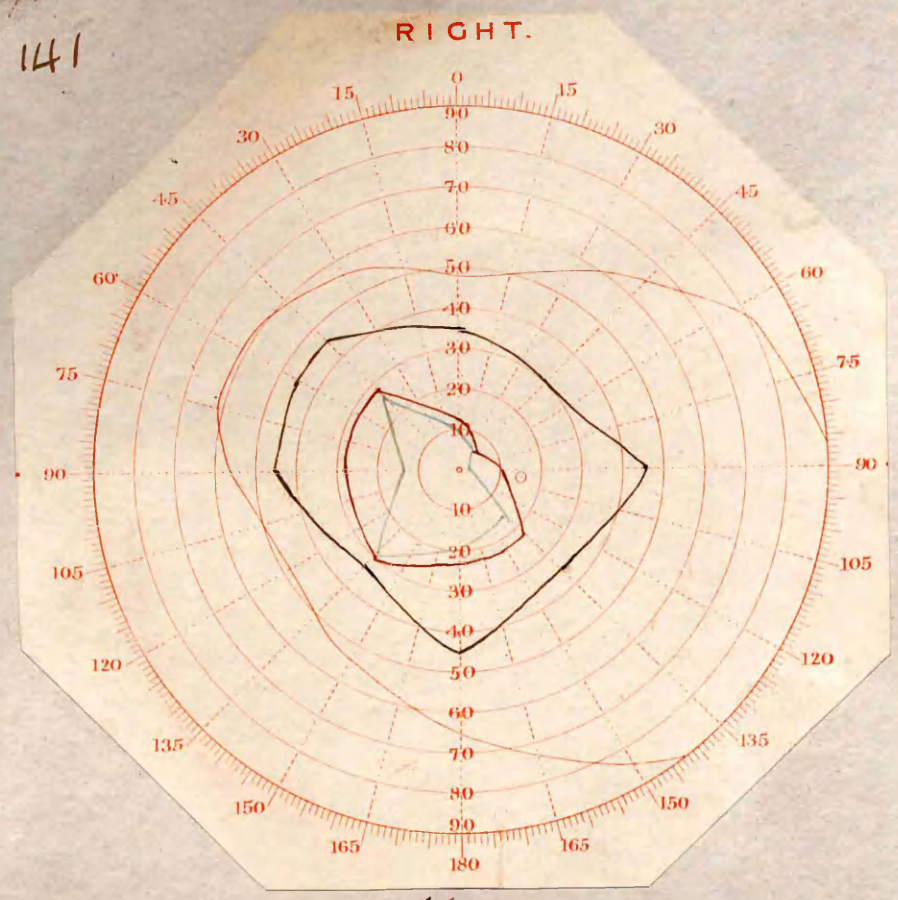
C

Plate 4

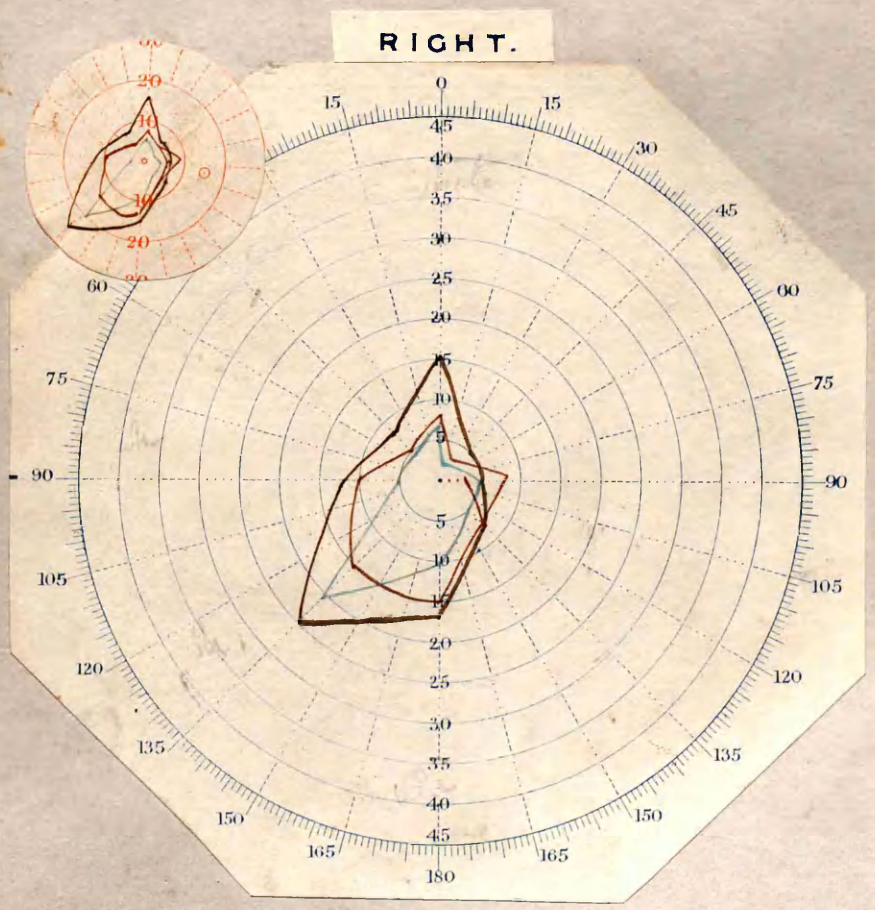
Donald S. aet 21.
Case 51. p. 141



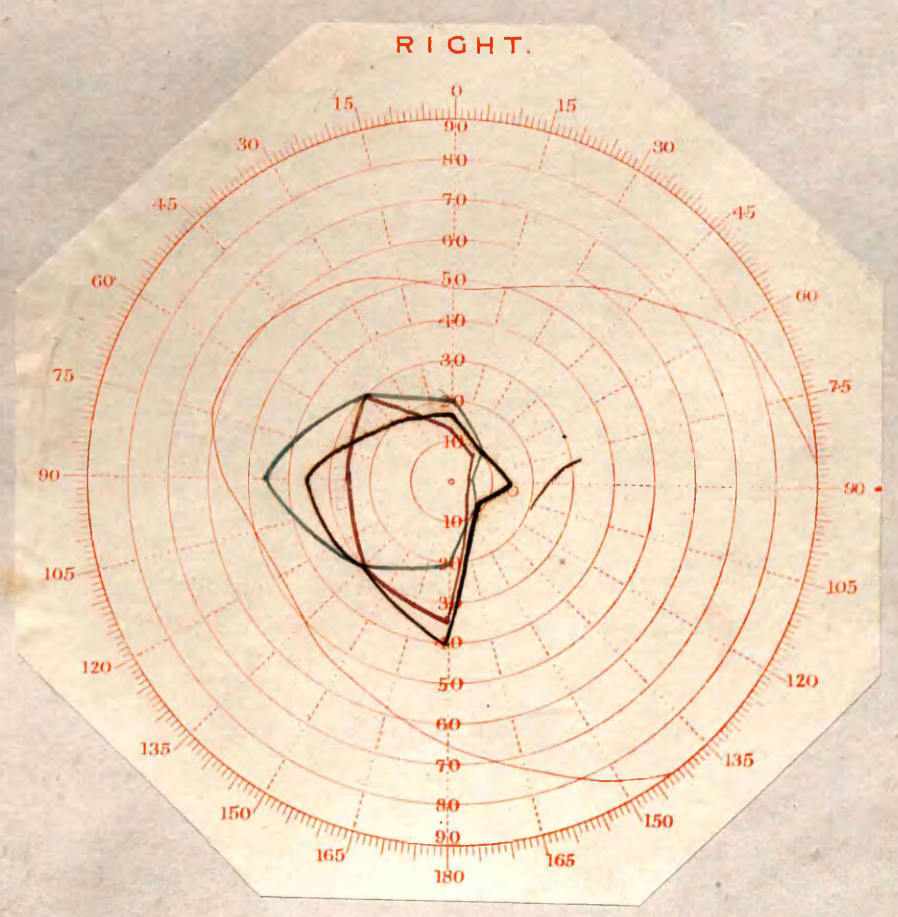
July 13: 87.



Sept 20: 87.



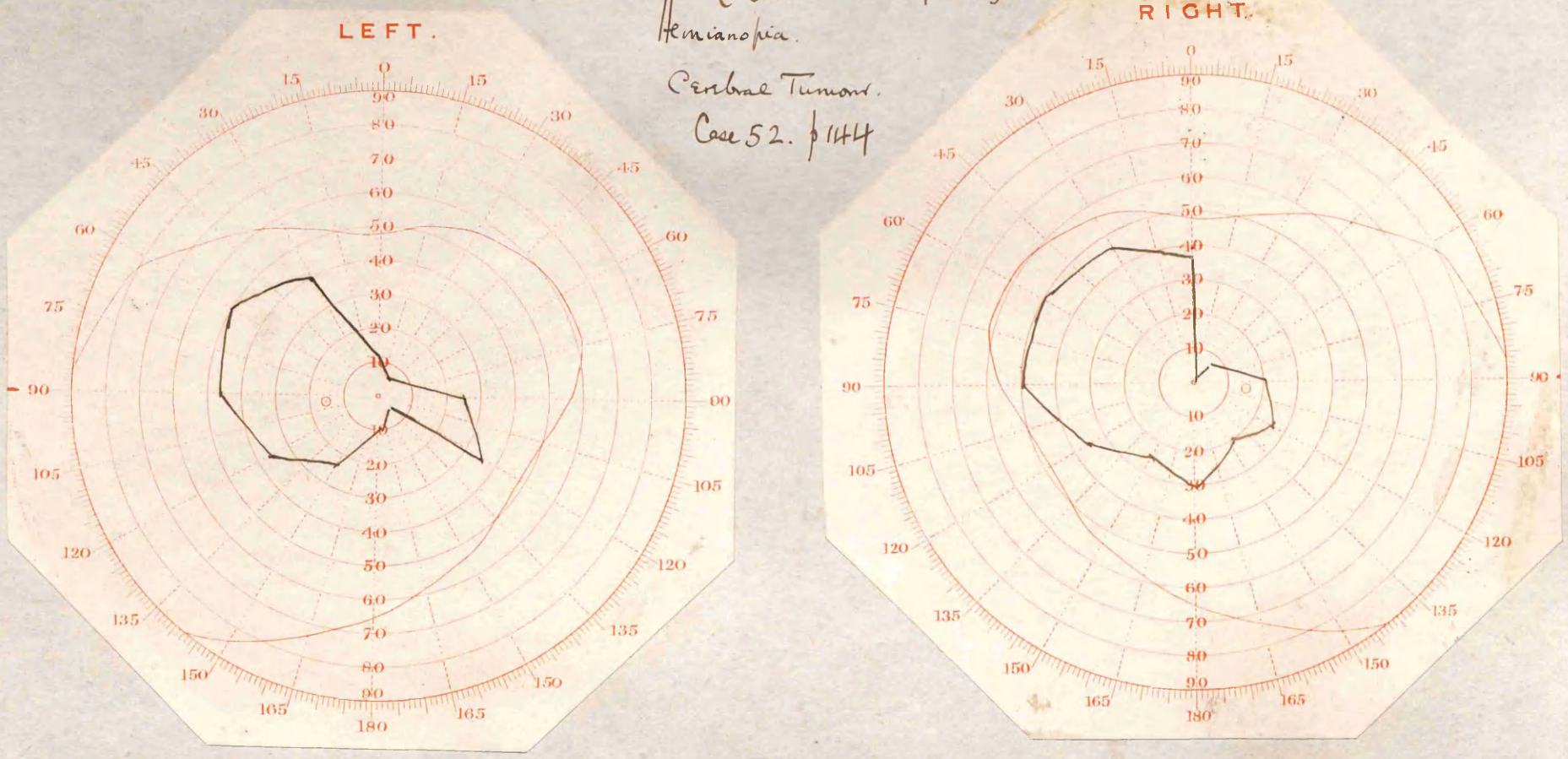
Feb: 8: 88.



March : 6 : 88.

Plate 41.

Arch.d J. aet 25 no 51082.
(C&I. Journ. 13. p 470)
Hemianopia.
Cerebral Tumour.
Case 52. p 144



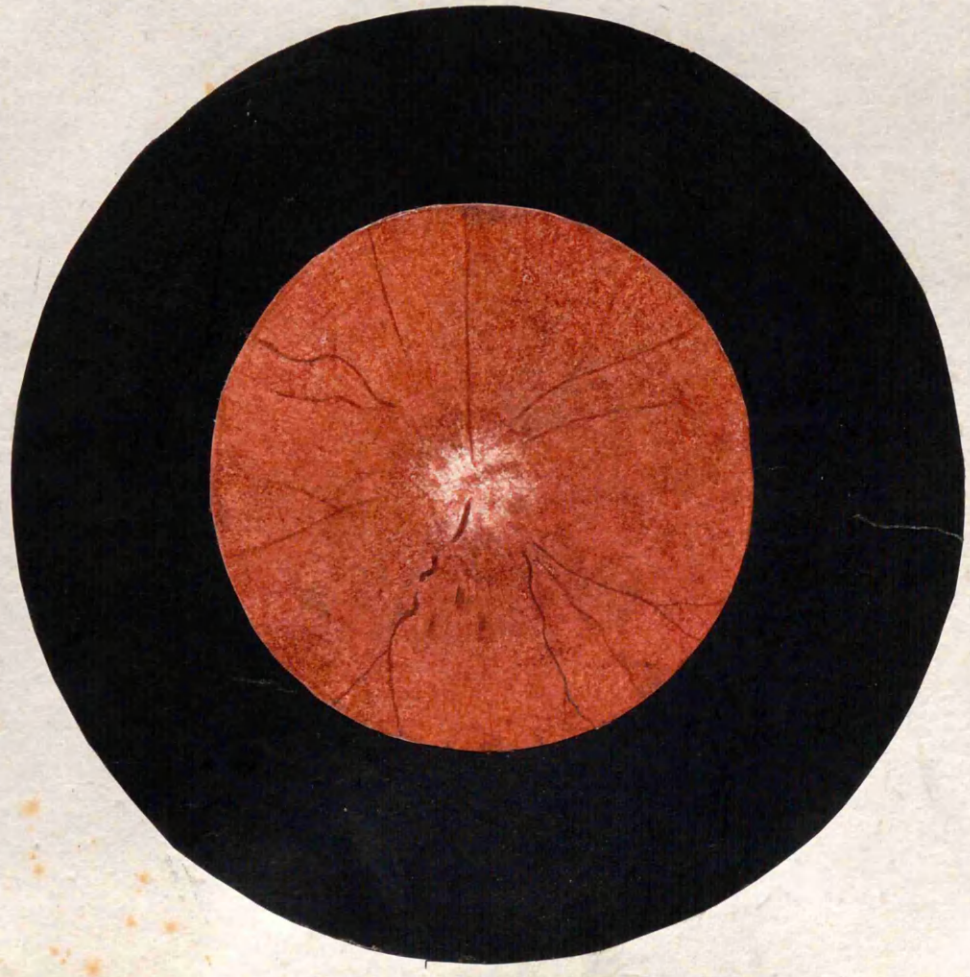
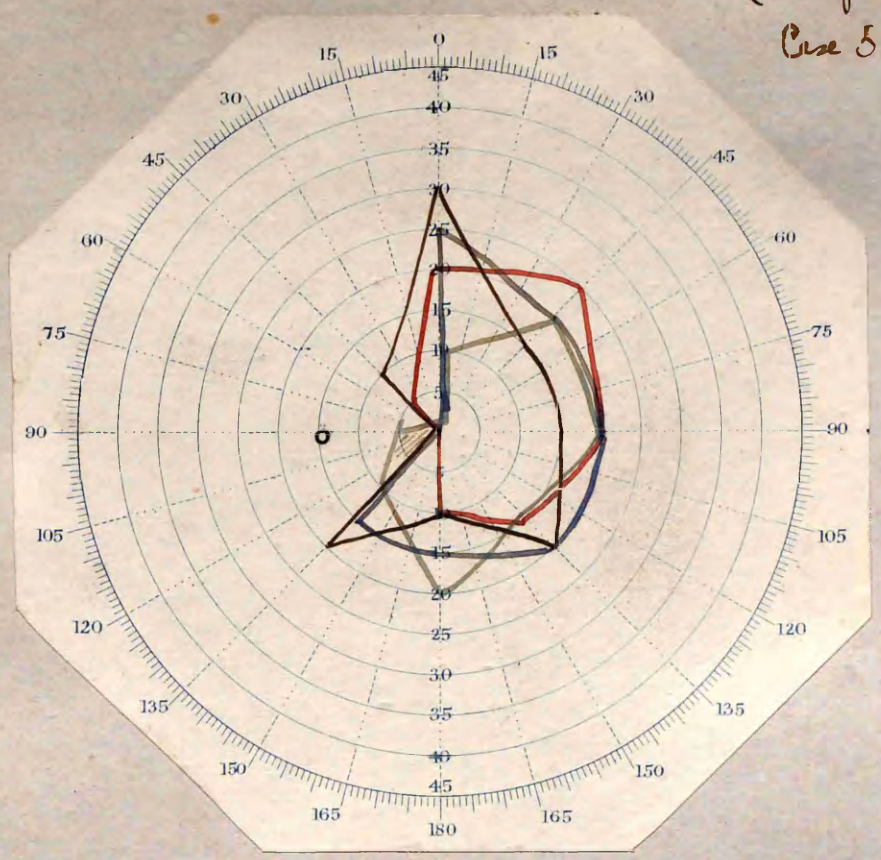


Plate LII.

Peter McK.. aet 31
(Case of P. Gairdner)
Case 53. ₱150.

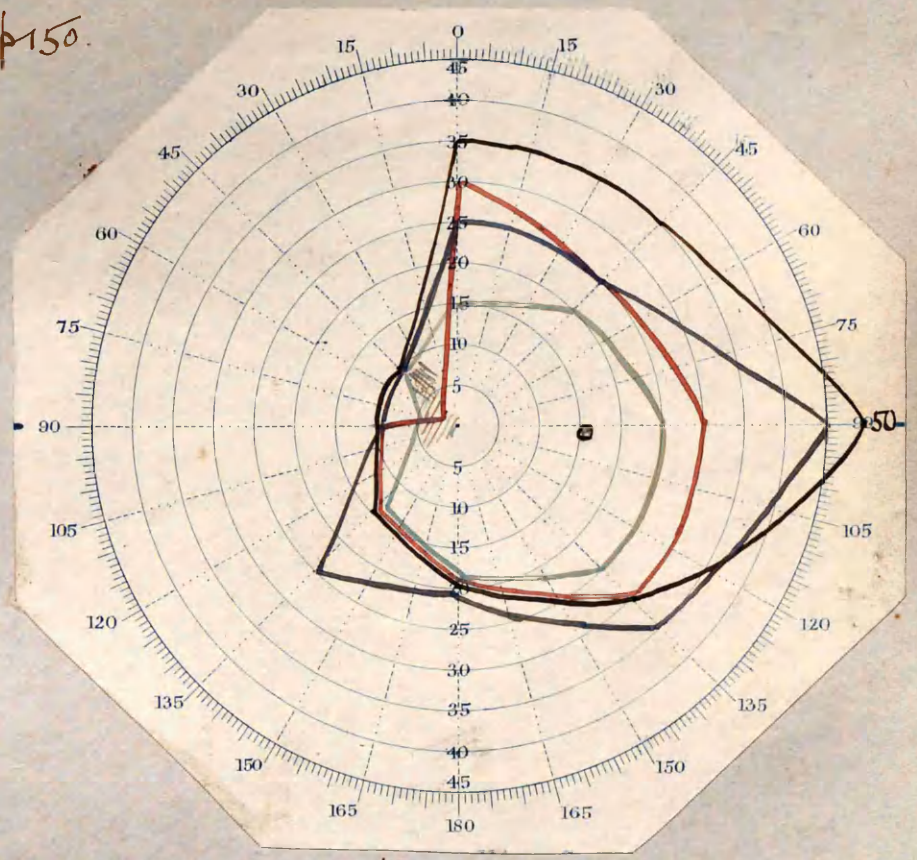
LEFT.



B

April 15: 88

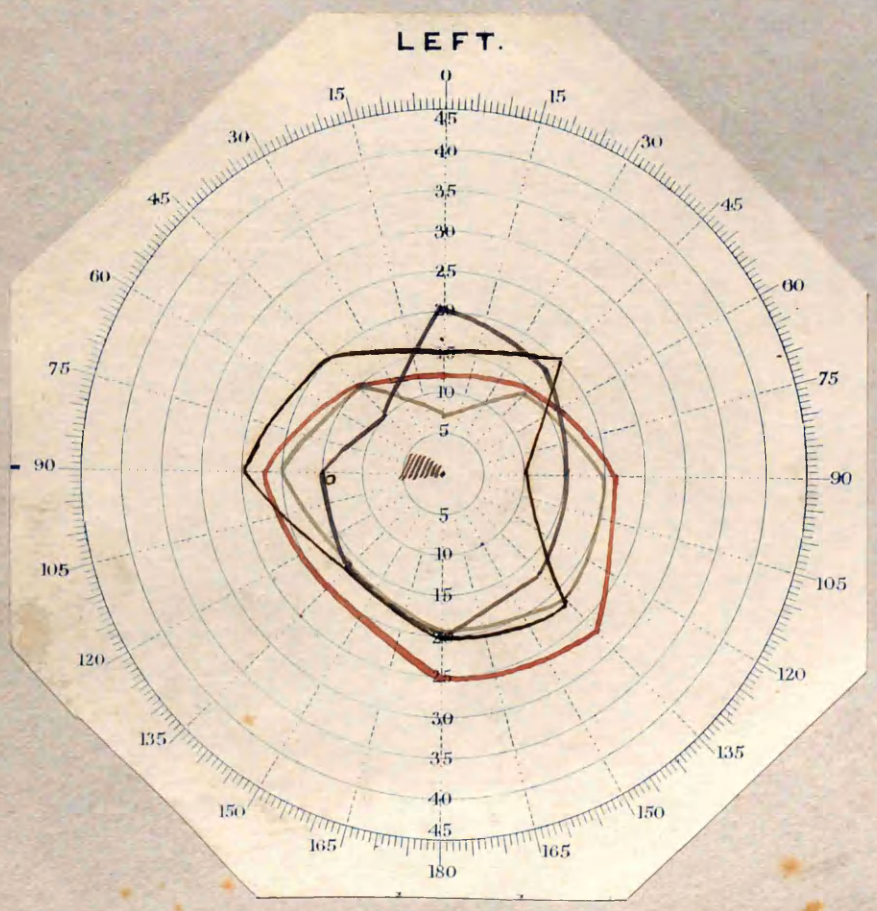
RIGHT.



A

April 15: 88.

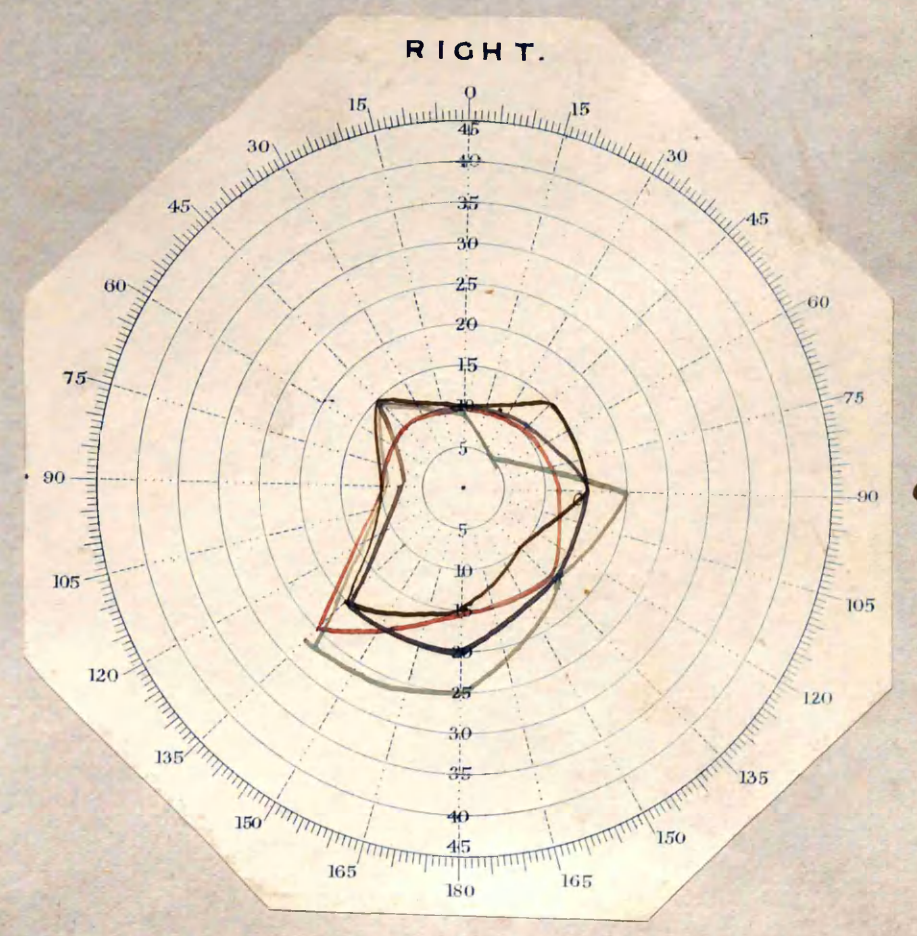
LEFT.



D

May 24: 88

RIGHT.



C

May 24: 88